SOLICITATION, OFFER AND AWARD	1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 350) ▶	RATING DO-C9	PAGE OF 1 31 PAGES

2. CONTRACT NO.	3. SOLICITATION NO.	4. TYPE OF SOLICITATION	5. DATE ISSUED	6. REQUISITION/PURCHASE NO.
	N00173-01-R-MS01	☐ SEALED BID (IFB) ☒ NEGOTIATED (RFP)	09 FEB 2001	57-1146-01

7. ISSUED BY	CODE	8. ADDRESS OFFER TO *(If other than Item 7)*
CONTRACTING OFFICER NAVAL RESEARCH LABORATORY ATTN: CODE 3220.MS WASHINGTON DC 20375-5326	N00173	

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder".

SOLICITATION

9. Sealed offers in original and 4 copies for furnishing the supplies or services in the Schedule will be received at the place specified in Item 8, or if handcarried, in the depository located in Bldg. 222, Room 115 until 4:00pm *(Hour)* local time 19 MAR 2001 *(Date)*

CAUTION - LATE Submissions, Modifications, and Withdrawals: See Section L, Provision No. 52.214-7 or 52.215-10. All offers are subject to all terms and conditions contained in this solicitation.

10. FOR INFORMATION CALL: ▶	A. NAME	B. TELEPHONE NO. *(Include area code) (NO COLLECT CALLS)*
	Ms.Mary Sandy (sandy@contracts.nrl.navy.mil)	202-767-3710

11. TABLE OF CONTENTS

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OFFER *(Must be fully completed by offeror)*

NOTE: Item 12 does not apply if the solicitation includes the provisions at 52.214-16, Minimum Bid Acceptance Period.

12. In compliance with the above, the undersigned agrees, if this offer is accepted within _____ calendar days *(60 calendar days unless a different period is inserted by the offeror)* from the date for receipt of offers specified above, to furnish any or all items upon which prices are offered at the price set opposite each item, delivered at the designated point(s), within the time specified in the schedule.

13. DISCOUNT FOR PROMPT PAYMENT *(See Section I, Clause No. 52-232-8)* ▶	10 CALENDAR DAYS %	20 CALENDAR DAYS %	30 CALENDAR DAYS %	CALENDAR DAYS %

14. ACKNOWLEDGMENT OF AMENDMENTS *(The offeror acknowledges receipt of amendments to the SOLICITATION for offerors and related documents numbered and dated:*	AMENDMENT NO.	DATE	AMENDMENT NO.	DATE

15A. NAME AND ADDRESS OF OFFEROR	CODE	FACILITY	16. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*

15B. TELEPHONE NO. *(Include area code)*	15C. ☐ CHECK IF REMITTANCE ADDRESS IS DIFFERENT FROM ABOVE - ENTER SUCH ADDRESS IN SCHEDULE.	17. SIGNATURE	18. OFFER DATE

AWARD *(To be completed by Government)*

19. ACCEPTED AS TO ITEMS NUMBERED	20. AMOUNT	21. ACCOUNTING AND APPROPRIATION

22. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:

☐ 10 U.S.C. 2304(c) ( ) ☐ 41 U.S.C. 253(c) ( )

23. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified)* ▶	ITEM

24. ADMINISTERED BY *(If other than Item 7)*	CODE	25. PAYMENT WILL BE MADE BY	CODE

26. NAME OF CONTRACTING OFFICER *(Type or print)*	27. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*	28. AWARD DATE

IMPORTANT - Award will be made on this Form, or on Standard Form 26, or by other authorized official written notice.

PART I - THE SCHEDULE
SECTION B
SUPPLIES OR SERVICES AND PRICES/COSTS

B-1 SUPPLIES/SERVICES AND COSTS

CONTRACT TYPE –COST PLUS FIXED FEE (CLINS 0001 THROUGH 0026)**

ITEM NUMBER	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	ESTIMATED COST PLUS FIXED FEE
Basic Contract				
0001	The Contractor shall provide engineering support for the prototype Dragon Eye System final development in accordance with Section C-1.	$	$	$
0002	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP
OPTION 1				
0003	The Contractor shall fabricate, integrate, assemble, test, and deliver **ten** Dragon Eye Systems in accordance with Section C-1.	$	$	$
0004	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0005	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP

OPTION 2

0006	The Contractor shall fabricate, integrate, assemble, test, and deliver **ten** Dragon Eye Systems in accordance with Section C-1.	$	$	$
0007	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0008	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP

OPTION 3

0009	The Contractor shall fabricate, integrate, and assemble, test, and deliver **ten** Dragon Eye Systems in accordance With Section C-1.	$	$	$
0010	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0011	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP

OPTION 4

0012	The Contractor shall fabricate, integrate, assemble, test, and deliver **ten** Dragon Eye Systems in accordance with Section C-1.	$	$	$
0013	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0014	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP

OPTION 5

0015	The Contractor shall fabricate, integrate, assemble, test, and deliver **ten** Dragon Eye Systems in accordance with Section C-1.	$	$	$
0016	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0017	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP

OPTION 6

0018	The Contractor shall fabricate, integrate, assemble, test, and deliver **ten** Dragon Eye Systems in accordance With Section C-1.	$	$	$
0019	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0020	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP

OPTION 7

0021	The Contractor shall fabricate, integrate, assemble, test, and deliver **ten** Dragon Eye Systems in accordance with Section C-1.	$	$	$
0022	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0023	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP

OPTION 8

0024	The Contractor shall fabricate, integrate, assemble, test, and deliver **ten** Dragon Eye Systems in accordance with Section C-1.	$	$	$
0025	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	$	$	$
0026	Data in accordance with Exhibit A (DD 1423).	* NSP	* NSP	* NSP
TOTAL EST. COST PLUS FIXED FEE		$	$	$

* *Not Separately Priced*

CONTRACT TYPE - FIRM FIXED PRICE (CLINS 0027 THROUG 0042)

ITEM NUMBER	SUPPLIES OR SERVICES	QTY	UNIT	UNIT PRICE	AMOUNT
OPTION 9					
0027	The Contractor shall provide Dragon Eye Air Vehicles in accordance with Section C-1.	250	EA	TBD	TBD
0028	The Contractor shall provide ground control systems in accordance with Section C-1.	40	EA	TBD	TBD
0029	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	1	LO	TBD	TBD
0030	Data in accordance with Exhibit A (DD 1423).	* NSP		* NSP	* NSP
OPTION 10					
0031	The Contractor shall provide Dragon Eye Air Vehicles in accordance with Section C-1.	250	EA	TBD	TBD
0032	The Contractor shall provide ground control systems in accordance with Section C-1.	40	EA	TBD	TBD
0033	The Contractor shall provide logistics and maintenance support. in accordance with Section C-1.	1	LO	TBD	TBD
0034	Data in accordance with Exhibit A (DD 1423).	* NSP		* NSP	* NSP

OPTION 11

0035	The Contractor shall provide Dragon Eye Air Vehicles in accordance with Section C-1.	250	EA	TBD	TBD
0036	The Contractor shall provide ground control systems in accordance with Section C-1.	40	EA	TBD	TBD
0037	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	1	LO	TBD	TBD
0038	Data in accordance with Exhibit A (DD 1423).	* NSP		* NSP	* NSP

OPTION 12

0039	The Contractor shall provide Dragon Eye Air Vehicles in accordance with Section C-1.	250	EA	TBD	TBD
0040	The Contractor shall provide ground control systems in accordance with Section C-1.	40	EA	TBD	TBD
0041	The Contractor shall provide logistics and maintenance support in accordance with Section C-1.	1	LO	TBD	TBD
0042	Data in accordance with Exhibit A (DD 1423).	* NSP		* NSP	* NSP

* *Not Separately Priced*
** *Contract Line Item Number*

SECTION C
DESCRIPTION/SPECIFICATIONS/STATEMENT OF WORK

C-1 STATEMENT OF WORK

The work and services to be performed hereunder shall be subject to the requirements and standards contained in Attachment (1), Statement of Work, with Exhibit A, Contract Data Requirements List, and all other Attachments cited in Section J, which are incorporated by reference into Section C-1.

C-2 REQUIREMENTS FOR ON-SITE CONTRACTORS

For those portions of the work under this contract performed at any NRL site, the contractor shall comply with the Requirements for On-Site Contractors dated 11 April 2000 which are hereby incorporated by reference. The full text is available at http://heron.nrl.navy.mil/contracts/home.htm.

SECTION D
PACKAGING AND MARKING

D-1 PACKAGING AND MARKING

Preservation, packaging, packing and marking of all deliverable contract line items must conform to normal commercial packing standards to assure safe delivery at destination.

SECTION E
INSPECTION AND ACCEPTANCE

E-1 INSPECTION AND ACCEPTANCE CLAUSES INCORPORATED BY REFERENCE

FAR CLAUSE		TITLE
52.246-8	-	Inspection Of Research And Development - Cost Reimbursement (APR 1984)
52.246-9	-	Inspection Of Research And Development (Short Form) (APR 1984)

E-2 INSPECTION AND ACCEPTANCE

Inspection and acceptance of the final delivery will be accomplished by the Technical Manager (TM) or Contracting Officer Representative (COR) designated in Section G of this contract. Inspection and acceptance will be performed at the Naval Research Laboratory, Washington DC 20375-5320.

SECTION F
DELIVERIES OR PERFORMANCE

F-1 DELIVERIES OR PERFORMANCE CLAUSES INCORPORATED BY REFERENCE:

FAR CLAUSE		TITLE
52.242-15	-	Stop-Work Order (AUG 1989) - Alternate I (APR 1984)
52.247-34	-	F.O.B. Destination (NOV 1991)

F-2 PERIOD AND PLACE OF PERFORMANCE

(a) The term of this contract is from date of award through twelve weeks.
(b) Options 1 through 8, if exercised, are each for the delivery of ten Dragon Eye Systems. Delivery is required three months from date of exercise of these options. These options can be exercised concurrently.
(c) Delivery requirements of Options 9 through 12, if exercised, will be negotiated at time of exercise of option.
(d) The principal place of performance of this contract shall be *.

(*To be competed at time of award)

F-3 PLACE OF DELIVERY - FOB DESTINATION

The contractor shall deliver CLINs 0003 through 0026, if exercised, with all transportation charges paid, to destination in accordance with the clause in Section F of the Schedule titled FAR 52.247-34 FOB Destination (NOV 1991). Destination of CLINs 0027, 0028, 0031, 0032, 0035, 0036, 0039, and 0040, if exercised, will be established at time of option exercise.

Receiving Officer
Naval Research Laboratory
Contract Number
ATTN: *
CODE: *
LOCATION: *
4555 Overlook Avenue, SW
Washington DC 20375-5320

(* To be filled in at time of award.)

SECTION G
CONTRACT ADMINISTRATION DATA

G-1 PROCURING OFFICE REPRESENTATIVE

In order to expedite administration of the contract, the Administrative Contracting Officer (ACO) will direct inquiries to the appropriate office listed below. Please do not direct routine inquiries to the person listed in Item 20A on Standard Form 26.

Contract Matters- *

Security Matters- *

Safety Matters- *

Patent Matters- *

Release of Data- *

The ACO will forward invention disclosures and reports directly to the Associate Counsel for Patents, Code 1008.2, Naval Research Laboratory, Washington DC 20375-5320. The Associate Counsel for Patents will return the reports along with a recommendation to the Administrative Contracting Officer. The Associate Counsel for Patents will represent the Contracting Officer with regard to invention reporting matters arising under this contract.

*(* To be completed at time of award)*

G-2 CONTRACTING OFFICER'S REPRESENTATIVE (COR) - FUNCTIONS AND LIMITATIONS

* is hereby designated the cognizant COR who will represent the Contracting Officer in the administration of technical details within the scope of this contract and inspection and acceptance. The COR is not otherwise authorized to make any representations or commitments of any kind on behalf of the Contracting Officer or the Government. The COR does not have the authority to alter the Contractor's obligations or change the specifications in the contract. If, as a result of technical discussions, it is desirable to alter contract obligations or statements of work, a modification must be issued in writing and signed by the Contracting Officer. The COR is responsible for reviewing the bills and charges submitted by the Contractor and informing the ACO of areas where exceptions are to be taken.

*(* To be completed at time of award)*

G-3 ONR 5252.242-9718 - TECHNICAL DIRECTION (DEC 88)

(a) Performance of the work hereunder is subject to the technical direction of the Scientific Officer/COR designated in this contract or his duly authorized representative. For the purposes of this clause, technical direction includes the following:

(1) Direction to the Contractor which shifts work emphasis between work areas or tasks, requires pursuit of certain lines of inquiry, fills in details or otherwise serves to accomplish the objectives described in the statement of work;

(2) Guidelines to the Contractor which assist in the interpretation of drawings, specifications or technical portions of work description.

(b) Technical direction must be within the general scope of work stated in the contract. Technical instructions may not be used to:

(1) Assign additional work under the contract
(2) Direct a change as defined in the contract clause entitled "Changes";
(3) Increase or decrease the estimated contract cost, the fixed fee, or the time required for contract performance; or
(4) Change any of the terms, conditions or specifications of the contract.

(c) The only individual authorized to in any way amend or modify any of the terms of this contract shall be the Contracting Officer. When, in the opinion of the Contractor, any technical instruction calls for effort outside the scope of the contract or inconsistent with this special provision, the Contractor shall notify the Contracting Officer in writing within ten working days after its receipt. The Contractor shall not proceed with the work affected by the technical direction until the Contractor is notified by the Contracting Officer that the technical direction is within the scope of the contract.

(d) Nothing in the foregoing paragraphs may be construed to excuse the Contractor from performing that portion of work statement which is not affected by the disputed technical instruction.

G-4 NAPS 5252.232-9001 - SUBMISSION OF INVOICES (COST-REIMBURSEMENT, TIME-AND-MATERIALS, LABOR-HOUR, OR FIXED PRICE INCENTIVE (JUL 1992)

(a) "Invoice" as used in this clause includes contractor requests for interim payments using public vouchers (SF 1034) but does not include contractor requests for progress payments under fixed price incentive contracts.

(b) The Contractor shall submit invoices and any necessary supporting documentation, in an original and 4 copies, to the contract auditor at the following address:

(To be completed at time of award)

unless delivery orders are applicable, in which case invoices will be segregated by individual order and submitted to the address specified in the order. In addition, an information copy shall be submitted to [See Section G for designated COR]. Following verification, the contract auditor will forward the invoice to the designated payment office for payment in the amount determined to be owing, in accordance with the applicable payment (and fee) clause(s) of this contract.

(c) Invoices requesting interim payments shall be submitted no more than once every two weeks, unless another time period is specified in the Payments clause of this contract. For indefinite delivery type contracts, interim payment invoices shall be submitted no more than once every two weeks for each delivery orders. There shall be a lapse of no more than 30 calendar days between performance and submission of an interim payment invoice.

(d) In addition to the information identified in the Prompt Payment clause herein, each invoice shall contain the following information, as applicable:

(1) Contract line item number (CLIN)
(2) Subline item number (SLIN)
(3) Accounting Classification Reference Number(ACRN)
(4) Payment terms
(5) Procuring activity

(6) Date supplies provided or services performed
(7) Costs incurred and allowable under the contract
(8) Vessel (e.g., ship, submarine or other craft) or system for which supply/service is provided

(e) A DD Form 250, "Material Inspection and Receiving Report,"
- ☐ is required with each invoice submittal.
- ☐ is required only with the final invoice.
- ☒ is not required.

(f) A Certificate of Performance
- ☐ shall be provided with each invoice submittal.
- ☒ is not required.

(g) The Contractor's final invoice shall be identified as such, and shall list all other invoices (if any) previously tendered under this contract.

(h) Cost of performance shall be segregated, accumulated and invoiced to the appropriate ACRN categories to the extent possible. When such segregation of costs by ACRN is not possible for invoices submitted with CLIN/SLINS with more than one ACRN, an allocation ratio shall be established in the same ratio as the obligations cited in the accounting data so that costs are allocated on a proportional basis.

G-5 PAYMENT OF FIXED FEE (COMPLETION FORM)

The fixed fee set forth in Section B of this contract shall be payable on completion of the work and services required under each CLIN of this contract and their acceptance on behalf of the Government. However, the contractor may bill on each voucher the amount of the fixed fee bearing the same percentage to the amount of cost billed as the total fixed fee bears to the total estimated cost set forth in Section B, subject to the contract clause entitled "Fixed Fee" (FAR 52.216-8). If the fixed fee is reduced pursuant to any clause or requirement of this contract and the reduced fee is less than the sum of all fee payments made to the contractor under this contract, the contractor shall repay the difference to the Government. The total fee paid the contractor shall not exceed the fixed fee set forth in Section B.

G-6 INCREMENTAL FUNDING

Pursuant to the Limitation of Funds clause (FAR 52.232-22), the total amount allotted to this contract is $* and it is estimated that this amount is sufficient for contract performance through * .
*(*this provision will be included and completed at time of award, if applicable)*

G-7 PAYMENT INSTRUCTIONS FOR MULTIPLE ACCOUNTING CLASSIFICATION CITATIONS (COST-REIMBURSEMENT)

The purpose of these instructions is to permit the paying office to charge the accounting classification citations in the contract in a manner that reflects the performance of the contract. These instructions do not create any obligation on the part of the Government or the contractor nor do they in any way alter any obligation created by any other provision of the contract. Invoices should be paid from available ACRNs in the following order:

(a) ACRNs cited on the contractor's invoice.

(b) On a proportional basis from any ACRNs assigned to funds which will cancel at the end of the current fiscal year.
(c) The ACRN assigned to the following line of accounting:
97X4930.NH4A 000 77777 0 000173 2F 000000 N00173Z45000.
(d) If funds appropriated in more than one fiscal year are allotted to the contract, the ACRN assigned to the oldest allotment of funds.
(e) On a proportional basis from all ACRNs assigned to allotments of funds appropriated in a single fiscal year.

G-8 SUBCONTRACTORS/CONSULTANTS

(a) Advance notification or requests for consent pursuant to the contract clause entitled "Subcontracts" (FAR 52.244-2) shall be directed to the cognizant administrative contracting officer (ACO).
(b) The following subcontractors/consultants have been identified in the Contractor's proposal as necessary for performance of this contract:

Subcontractor/Consultant Name	Estimated Cost

(Paragraph (b) will be included and filled in at time of award if subcontractor/consultants are proposed by the successful offeror)

SECTION H
SPECIAL CONTRACT REQUIREMENTS

H-1 TYPE OF CONTRACT

This is a *

*(*To be completed at time of award)*

H-2 ONR 5252.237-9705 - KEY PERSONNEL (DEC 88)

(a) The Contractor agrees to assign to the contract tasks those persons whose resumes were submitted with its proposal and who are necessary to fulfill the requirements of the contract as "key personnel." No substitutions may be made except in accordance with this clause.
(b) The Contractor understands that during the first ninety-(90) days of the contract performance period, no personnel substitutions will be permitted unless these substitutions are unavoidable because of the incumbent's sudden illness, death or termination of employment. In any of these events, the Contractor shall promptly notify the Contracting Officer and provide the information described in paragraph (c) below. After the initial ninety (90) day period the Contractor must submit to the Contracting Officer all proposed substitutions, in writing, at least fifteen (15) days in advance (thirty (30) days if security clearance must be obtained) of any proposed substitution and provide the information required by paragraph (c) below.

(c) Any request for substitution must include a detailed explanation of the circumstances necessitating the proposed substitution, a resume for the proposed substitute, and any other information requested by the Contracting Officer. Any proposed substitute must have qualifications equal to or superior to the qualifications of the incumbent. The Contracting Officer or his/her authorized representative will evaluate such requests and promptly notify the Contractor of his/her approval or disapproval thereof.
(d) In the event that any of the identified key personnel cease to perform under the contract and the substitute is disapproved, the contract may be immediately terminated in accordance with the Termination clause of the contract.
The following are identified as key personnel: *

Labor Category	Name
Senior Engineer	*

*(*To be completed at time of award)*

H-3 LEVEL OF EFFORT *(CLINS 0001 AND 0002)*

(a) The Contractor agrees to provide the total level of effort specified in the next sentence in performance of the work described in CLINS 0001 & 0002. The total level of effort shall under the base support shall be 1,440 total hours of direct labor, including subcontractor direct labor for those subcontractors specifically identified in the Contractor's proposal as having hours included in the proposed level of effort. A breakdown of labor categories and hours is set forth in paragraph (k) below.
(b) The level of effort for this contract under the base support shall be expended at an average rate of 120 hours per week. It is understood and agreed that the rate of hours per week may fluctuate in pursuit of the technical objective, provided such fluctuation does not result in the use of the total hours of effort prior to the expiration of the term of the contract.
(c) The Contractor is required to notify the Contracting Officer when 85% of the total level of effort has been expended.
(d) If, during the term of the contract, the Contractor finds it necessary to accelerate the expenditure of direct labor to such an extent that the total hours of effort specified would be used prior to the expiration of the term, the Contractor shall notify the Contracting Officer in writing, setting forth the acceleration required, the probable benefits which would result, and an offer to undertake the acceleration at no increase in the estimated cost or fixed fee together with an offer setting forth a proposed level of effort, cost breakdown, and proposed fixed fee for continuation of the work until expiration of the term hereof. The offer shall provide that the work proposed will be subject to the terms and conditions of this contract and any additions or changes required by then current law, regulations, or directives, and that the offer, with a written notice of acceptance by the Contracting Officer, shall constitute a binding contract. The Contractor shall not accelerate any effort until receipt of such written approval by the Contracting Officer. Any agreement to accelerate will be formalized by contract modification.

(e) The Contracting Officer may, by written order, direct the Contractor to accelerate the expenditure of direct labor such that the total hours of effort specified in paragraph (a) above would be used prior to the expiration of the term. This order shall specify the acceleration required and the resulting revised term. The Contractor shall acknowledge this order within five days of receipt.
(f) If the total level of effort specified in paragraph (a) above is not provided by the Contractor during the term of this contract, the Contracting Officer shall either (i) reduce the fixed fee of this contract as follows:

$$\text{Fee Reduction} = \text{Fixed Fee} \times \frac{\text{Required LOE Hours} - \text{Expended LOE Hours}}{\text{Required LOE Hours}}$$

or (ii) subject to the provisions of the clause of this contract entitled "Limitation of Cost," require the Contractor to continue to perform the work until the total number of hours of direct labor specified in paragraph (a) shall have been expended, at no increase in the fixed fee of this contract.
(g) In the event the government fails to fully fund the contract in a timely manner, the term of the contract may be extended accordingly with no change to cost or fee. If the government fails to fully fund the contract, the fee will be adjusted in direct proportion to that effort which was performed.
(h) Notwithstanding any of the provisions in the above paragraphs, the Contractor may furnish hours up to five percent in excess of the total hours specified in paragraph (a) above, provided that the additional effort is furnished within the term hereof, and provided further that no increase in the estimated cost or fixed fee is required, and no adjustment in the fixed fee shall be made provided that the Contractor has delivered at least 95% of the level of effort required in paragraph (a) above.
(i) It is understood that the mix of labor categories provided by the Contractor under the contract, as well as the distribution of effort among those categories, may vary considerably from the initial mix and distribution of effort which was estimated by the government or proposed by the Contractor.
(j) Nothing herein shall be construed to alter or waive any of the rights or obligations of either party pursuant to the Clause entitled "Limitation of Costs" or "Limitation of Funds," either of which clauses as incorporated herein applies to this contract.
(k) The anticipated breakdown by labor category of the total level of effort is as follows:

Labor Category	Hours
Senior Engineer	480
Electronics Engineering Technician	480
Mechanical Engineering Technician	480
Total	1,440

H-4 ONR 5252.235-9714 - REPORT PREPARATION (FEB 97)

Scientific or technical reports prepared by the Contractor and deliverable under the terms of this contract will be prepared in accordance with format requirements contained in ANSI/NISO Z39.18-1995, "Scientific and Technical Reports: Elements, Organization, and Design. "[NOTE: ANSI Z39.18 may be obtained from NISO Press Fulfillment Center, P. O. Box 338, Oxon Hill, MD. 20750-0338.Telephone 1-800-282-6476]

H-5 OPTIONS 1 THROUGH 8

The Government may require performance of the numbered line items identified in the Schedule as optional items at the price stated in the Schedule. The Contracting Officer may unilaterally exercise the option by written notice to the Contractor anytime prior to the current completion date of the contract.

H- 6 OPTIONS 9 THROUGH 12

Within 30 days from acceptance of CLIN 0003, the contractor shall provide a firm fixed price proposal including delivery schedule for options 9 through 12. Upon conclusion of negotiations, the Government may issue a separate firm fixed price contract for the optional items. The awarding contracting office for the optional items may be other than the contracting office for this contract.

H-7 GOVERNMENT-FURNISHED PROPERTY

The following Government property will be furnished to the contractor on a rent-free basis for use in performing the contract for **OPTION 1 ONLY**:

(a) Drawing and data package detailing:
- components requiring fabrication, including critical dimensions, tolerances, and lamination schedules for composite materials;
- interrelationships of all components;
- wiring diagrams;
- functional block diagrams;
- materials list;
- COTS components source list; and
- notes that describes critical aspects and requirements for fabrication, assembly, integration and checkout.

(b) One (1) set of tooling and molds for the airframe.

(c) Two (2) brushless DC Electric Propulsion Motors with associated gearboxes and sensorless controllers for each airframe.

(d) One (1) GPS-based autopilot with navigator for each airframe.

(e) One (1) EUT+ with GOTS software.

Items (c) and (d) shall be installed by the contractor in the Dragon Eye Systems. At the completion of Option 1, the contractor shall return items (b) and (e).

H-8 YEAR 2000 COMPLIANT INFORMATION TECHNOLOGY

This requirement applies to information technology (IT) that processes date-related information. All such IT delivered under this contract shall be Year 2000 compliant as defined at FAR 39.002.

H-9 REPRESENTATIONS AND CERTIFICATIONS

The Contractor's completed Representations, Certifications, and Other Statements of Offerors or Respondents is incorporated herein by reference in any resultant award.

PART II - CONTRACT CLAUSES
SECTION I
CONTRACT CLAUSES

I-1 52.252-2 - CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

http://www.arnet.gov/far
http://heron.nrl.navy.mil/contracts/home.htm

a. FEDERAL ACQUISITION REGULATION CLAUSES

FAR CLAUSE		TITLE
52.202-1	-	Definitions (OCT 1995)
52.203-3	-	Gratuities (APR 1984)
52.203-5	-	Covenant Against Contingent Fees (APR 1984)
52.203-6	-	Restrictions On Subcontractor Sales To The Government (JUL 1995)
52.203-7	-	Anti-Kickback Procedures (JUL 1995)
52-203-8	-	Cancellation, Rescission, And Recovery Of Funds For Illegal Or Improper Activity (JAN 1997)
52.203-10	-	Price Or Fee Adjustment For Illegal Or Improper Activity (JAN 1997)
52.203-12	-	Limitation On Payments To Influence Certain Federal Transactions (JUN 1997)
52.204-2	-	Security Requirements (AUG 1996)
52.204-4	-	Printed Or Copied Double-Sided On Recycled Paper (AUG 2000)
52.209-6	-	Protecting The Government's Interest When Subcontracting With Contractors Debarred, Suspended, Or Proposed For Debarment (JUL 1995)
52.211-6	-	Brand Name Or Equal (AUG 1999)
52.211-15	-	Defense Priority And Allocation Requirements (SEP 1990)
52.215-2	-	Audit And Records-Negotiation (JUNE 1999)
52.215-8	-	Order Of Precedence - Uniform Contract Format (OCT 1997)
52.215-11	-	Price Reduction For Defective Cost Or Pricing Data - Modifications (OCT 1997)
52.215-13	-	Subcontractor Cost Or Pricing Data Modifications (OCT 1997)

52.215-14 - Integrity Of Unit Prices (OCT 1997)
52.215-17 - Waiver Of Facilities Capital Cost Of Money (OCT 1997)
(will be included if the successful offeror does not propose facilities capital cost of money)
52.215-21 - Requirements For Cost And Pricing Data Or Information Other Than Cost Or Pricing Data - Modifications (OCT 1997) - Alternate IV (OCT 1997) (Fill in: See Section L- 12)
52.216-7 - Allowable Cost And Payment (MAR 2000))
52.216-8 - Fixed-Fee (MAR 1997)
52.219-6 - Notice Of Total Small-Business Set-Aside (JUL 1996)
52.219-8 - Utilization Of Small Business Concerns (OCT 2000)
52.219-14 - Limitations On Subcontracting (DEC 1996)
52.222-1 - Notice To The Government Of Labor Disputes (FEB 1997)
52.222-2 - Payment For Overtime Premiums (JUL 1990) -The Use Of Overtime Is Authorized Under This Contract If The Overtime Premium Does Not Exceed "0"
52.222-3 - Convict Labor (AUG 1996)
52.222-21 - Prohibition of Segregated Facilities (FEB 1999)
52.222-26 - Equal Opportunity (FEB 1999)
52.222-35 - Affirmative Action For Disabled Veterans And Veterans Of The Vietnam Era (APR 1998)
52.222-36 - Affirmative Action For Workers With Disabilities (JUN 1998)
52.222-37 - Employment Reports On Disabled Veterans And Veterans Of The Vietnam Era (APR 1998)
52.223-3 - Hazardous Material Identification And Material Safety Data (JAN 1997)
52.223-5 - Pollution Prevention And Right-To-Know Information (APR 1998)
52.223-6 - Drug-Free Workplace (JAN 1997)
52.223-14 - Toxic Chemical Release Reporting (OCT 2000)
52.225-13 - Restrictions On Certain Foreign Purchases (JUL 2000)
52.226-1 - Utilization Of Indian Organizations And Indian-Owned Economic Enterprises (JUN 2000)
52.227-1 - Authorization And Consent (JUL 1995)- Alternate I (APR 1984)
52.227-2 - Notice And Assistance Regarding Patent And Copyright Infringement (AUG 1996)
52.227-11 - Patent Rights - Retention By The Contractor (Short Form) (JUN 1997)
52.227-13 - Patent Rights - Acquisition By The Government (JAN 1997)
52.228-5 - Insurance - Work on a Government Installation (JAN 1997)
52.228-7 - Insurance - Liability To Third Persons (MAR 1996)
52.229-6 - Taxes - Foreign Fixed-Price Contracts (JAN 1991)
52.232-17 - Interest (JUN 1996)
52.232-18 - Availability Of Funds (APR 1984)
52.232-20 - Limitation Of Cost (APR 1984) *(Applicable when the contract or task order is fully funded)*
52.232-22 - Limitation Of Funds (APR 1984) *(Applicable when the contract or task order is not fully funded)*
52.232-23 - Assignment Of Claims (JAN 1986) Alternate I (APR 1984)
52.232-25 - Prompt Payment (JUN 1997)

52.232-33 - Payment By Electronic Funds Transfer-Central Contractor Registration (MAY 1999)
52.233-1 - Disputes (DEC 1998)
52.233-3 - Protest After Award (AUG 1996) - Alternate I (JUN 1985)
52.237-2 - Protection Of Government Buildings, Equipment And Vegetation (APR 1984)
52.237-10 - Identification of Uncompensated Overtime (OCT 1997)
52.239-1 - Privacy Or Security Safeguards (AUG 1996)
52.242-1 - Notice Of Intent To Disallow Costs (APR 1984)
52.242-3 - Penalties For Unallowable Costs (OCT 1995)
52.242-13 - Bankruptcy (JUL 1995)
52.243-2 - Changes - Cost-Reimbursement (AUG 1987) - Alternate V (APR 1984)
52.243-6 - Change Order Accounting (APR 1984)
52.243-7 - Notification Of Changes (APR 1984)fill in 30
52.244-2 - Subcontracts (AUG 1998) - Alternate I (AUG 1998)
52.244-6 - Subcontracts For Commercial Items And Commercial Components (OCT 1998)
52.245-5 - Government Property (Cost-Reimbursement, Time-And-Material, Or Labor-Hour Contracts) (JAN 1986) (DEVIATION)
52.245-19 - Government Property Furnished "As-Is" (APR 1984)
52.246-23 - Limitation Of Liability (FEB 1997)
52.246-24 - Limitation Of Liability - High-Value Items (FEB 1997)
52.246-25 - Limitation Of Liability - Services (FEB 1997)
52.247-1 - Commercial Bill Of Lading Notations (APR 1984)
52.247-63 - Preference For U. S. Flag Carriers (JAN 1997)
52.249-6 - Termination (Cost-Reimbursement) (SEP 1996)
52.249-14 - Excusable Delays (APR 1984)
52.251-1 - Government Supply Sources (APR 1984)
52.252-6 - Authorized Deviations in Clauses (APR 1984)(fill in Defense Federal Acquisition Regulation Supplement (48 CFR Chapter 2))
52.253-1 - Computer Generated Forms (JAN 1991)

b. DEPARTMENT OF DEFENSE FEDERAL ACQUISITION REGULATION CLAUSES

DFARS CLAUSE		TITLE
252.201-7000	-	Contracting Officer's Representative (DEC 1991)
252.203-7001	-	Prohibition On Persons Convicted Of Fraud Or Other Defense Contract Related Felonies (MAR 1999)
252.203-7002	-	Display Of DoD Hotline Poster (DEC 1991)
252.204-7000	-	Disclosure Of Information (DEC 1991)
252.204-7003	-	Control Of Government Personnel Work Product (APR 1992)
252.204-7004	-	Required Central Contractor Registration (MAR 2000)
252.204-7005	-	Oral Attestation Of Security Responsibilities (AUG 1999)
252.205-7000	-	Provision Of Information To Cooperative Agreement Holders (DEC 1991)
252.209-7000	-	Acquisition From Subcontractors Subject To On-Site Inspection Under The Intermediate-Range Nuclear Forces (INF) Treaty (NOV 1995)
252.215-7000	-	Pricing Adjustments (DEC 1991)
252.209-7004	-	Subcontracting With Firms That Are Owned Or Controlled By The Government Of A Terrorist Country (MAR 1998)

252.223-7001 - Hazard Warning Labels (DEC 1991)
252.223-7004 - Drug-Free Work Force (SEP 1988)
252.223-7006 - Prohibition On Storage And Disposal Of Toxic And Hazardous Materials (APR 1993)
252.225-7001 - Buy American Act And Balance Of Payments Program (MAR 1998)
252.225-7002 - Qualifying Country Sources As Subcontractors (DEC 1991)
252.225-7007 - Buy American Act--Trade Agreements—Balance Of Payments Program (APR 2000)
252.225-7012 - Preference For Certain Domestic Commodities (AUG 2000)
252.225-7016 - Restriction On Acquisition Of Ball And Roller Bearings (DEC 2000)
252.225-7021 - Trade Agreements (APR 2000)
252.225-7025 - Restriction On Acquisition Of Forgings (JUN 1997)
252.225-7026 - Reporting Of Contract Performance Outside The United States (JUN 2000)
252.225-7031 - Secondary Arab Boycott Of Israel (JUN 1992)
252.225-7043 - Antiterrorism/Force Protection Policy For Defense Contractors Outside The United States (JUN 1998) (fill in : Naval Criminal Investigative Service (NCIS), Code 24, telephone, DSN 228-9113 or commercial (202)433-9113)
252.227-7000 - Non Estoppel (OCT 1966)
252.227-7001 - Release Of Past Infringement (AUG 1984)
252.227-7013 - Rights In Technical Data -- Noncommercial Items (NOV 1995)
252.227-7014 - Rights In Noncommercial Computer Software And Noncommercial Computer Software Documentation (JUN 1995)
252.227-7016 - Rights In Bid Or Proposal Information (JUN 1995)
252.227-7019 - Validation Of Asserted Restrictions--Computer Software (JUN 1995)
252.227-7025 - Limitations On The Use Or Disclosure Of Government-Furnished Information Marked With Restrictive Legends (JUN 1995)
252.227-7030 - Technical Data--Withholding Of Payment (MAR 2000)
252.227-7034 - Patents--Subcontracts (APR 1984)
252.227-7036 - Declaration Of Technical Data Conformity (JAN 1997)
252.227-7037 - Validation Of Restrictive Markings On Technical Data (SEP 1999)
252.227-7039 - Patents--Reporting Of Subject Inventions (APR 1990)
252.232-7009 - Mandatory Payment By Government wide Commercial Purchase Card (JUL 2000)
252.235-7010 - Acknowledgment Of Support And Disclaimer (MAY 1995)
252.235-7011 - Final Scientific Or Technical Report (SEP 1999)
252.242-7000 - Post Award Conference (DEC 1991)
252.243-7002 - Requests For Equitable Adjustment (MAR 1998)
252.244-7000 - Subcontracts For Commercial Items And Commercial Components (DOD Contracts) (MAR 2000)
252.245-7001 - Reports Of Government Property (MAY 1994)
252.246-7001 - Warranty Of Data (DEC 1991)
252.247-7023 - Transportation Of Supplies By Sea (MAR 2000)
252.247-7024 - Notification Of Transportation Of Supplies By Sea (MAR 2000)
(will be included if the successful offeror made a negative response to the inquiry at DFARS 252.247-7022)
252.251-7000 - Ordering From Government Supply Sources (MAY 1995)

I-2 FAR 52.223-11 - OZONE-DEPLETING SUBSTANCES (JUN 1996)

(a) Definitions.

"Ozone-depleting substance", as used in this clause, means any substance designated as Class I by the Environmental Protection Agency (EPA) (40 CFR Part 82), including but not limited to chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform; or any substance designated as Class II by EPA (40 CFR Part 82), including but not limited to hydrochlorofluorocarbons.

(b) The Contractor shall label products which contain or are manufactured with ozone-depleting substances in the manner and to the extent required by 42 U.S.C. 7671j (b), (c), and (d) and 40 CFR Part 82, Subpart E, as follows:

"WARNING: Contains (or manufactured with, if applicable)_____*_____, a substance(s) which harm(s) public health and environment by destroying ozone in the upper atmosphere."

* The Contractor shall insert the name of the substance(s).

I-3 DFARS 252.225-7008 - SUPPLIES TO BE ACCORDED DUTY- FREE ENTRY (MAR 1998)

In accordance with paragraph (b) of the Duty-Free Entry clause of this contract, in addition to duty-free entry for all qualifying country supplies (end products and components) and all eligible end products subject to applicable trade agreements (if this contract contains the Buy American Act - Trade Agreements - Balance of Payments Program clause or the Buy American Act - North American Free Trade Agreement Implementation Act - Balance of Payments Program clause), the following foreign end products that are neither qualifying country end products nor eligible end products under a trade agreement, and the following nonqualifying country components, are accorded duty free entry.

_____

_____

_____

PART III - LIST OF DOCUMENTS, EXHIBITS, AND OTHER ATTACHMENTS
SECTION J
LIST OF ATTACHMENTS

J-1 Attachment (1) - Statement Of Work - 7 Pages, With Exhibit A - DD Form 1423, Contract Data Requirements List, 1 Page.

J-2 Attachment (2) – Requirements and Performance Specifications – 8 Pages.

J-3 Attachment (3) – Dragon Eye Project Description – 2 Pages.

J-4 Attachment (4) – Personnel Qualifications - 1 Page.

J-5 Attachment (5) - DD Form 254, Contract Security Classification Specification, Ser 004-01 Dated January 19, 2001 w/Attachments 2 Pages.

J-6 Attachment (6) – Industry Briefing - 57 pages
http://heron.nrl.navy.mil/contracts/RFP/01ms01.htm

J-7 Attachment (7) – White Paper, Affordably Expendable Unmanned Aerial Vehicles – 8 Pages

J-8 Attachment (8) – List of Attendees Requesting Attendance at Industry Brief, January 30, 2001 – 4 Pages

J-9 Attachment (9) – Video of Dragon Eye System presented at Industry Brief, January 30, 2001
http://heron.nrl.navy.mil/contracts/RFP/01ms01.htm

J-10 Attachment (10) – Accounting and Appropriation Data - 1 page. *

(To be included at time of award)*

PART IV - REPRESENTATIONS AND INSTRUCTIONS
SECTION - K
REPRESENTATIONS, CERTIFICATIONS
AND OTHER STATEMENTS OF OFFERORS OR RESPONDENTS

K-1 Representations, Certifications, and Other Statements of Offerors or Respondents

Each Offeror must submit a completed Representations, Certifications, and Other Statements Of Offerors or Respondents with its proposal which is available electronically in full text at http://heron.nrl.navy.mil/contracts/reps&certs.htm

K-2 FILL IN FOR FAR 52.219-1 - SMALL BUSINESS PROGRAM REPRESENTATIONS (OCT 2000)

The fill in information is as follows:

The NAICS code for this acquisition is 541710.
The small business size standard is 1500 employees.

SECTION L
INSTRUCTIONS CONDITIONS AND NOTICES TO OFFERORS OR RESPONDENTS

L-1 52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

http://www.arnet.gov/far
http://heron.nrl.navy.mil/contracts/home.htm

FAR CLAUSE		TITLE
52.204-6	-	Data Universal Numbering System (DUNS) Number (JUNE 1999)
52.214-34	-	Submission Of Offers In The English Language (APR 1991)
52.214-35	-	Submission Of Offers In U.S. Currency (APR 1991)
52.215-1	-	Instructions To Offerors- Competitive Acquisition (FEB 2000)
52.215-16	-	Facilities Capital Cost Of Money (OCT 1997)
52.219-24	-	Small Disadvantaged Business Participation Program - Targets (JAN 1999)
52.222-24	-	Preaward On-Site Equal Opportunity Compliance Evaluation (FEB 1999)
52.252-5	-	Authorized Deviations In Provisions (APR 1984)
252.204-7001	-	Commercial And Government Entity (CAGE) Code Reporting (AUG 1999)
252.211-7005	-	Substitutions For Military Or Federal Specifications And Standards (AUG 2000)

L-2 FAR 52.211-14 - NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be a ☐ DX rated order; ☒ DO rated order certified for national use under the Defense Priorities and Allocations system (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation.

L-3 FAR 52.215-20 REQUIREMENTS FOR COST OR PRICING DATA OR INFORMATION OTHER THAN COST OR PRICING DATA (OCT 1997)ALTERNATE IV (OCT 1997)

(a) Submission of cost or pricing data is not required.

(b) Provide information described below in Section L-12, Volume II Business.

L-4 FAR 52.216-1 - TYPE OF CONTRACT (APR 1984)

The Government contemplates award of Cost-Plus-Fixed-Fee Term type CLINs for the Basic Contract, CLINs 0001 and 0002; Cost-Plus-Fixed-Fee Completion type CLINs for Options 1 through 8; and Firm-Fixed price CLINs type for Options 9 through 12 resulting from this solicitation.

L-5 FAR 52.233-2 - SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in Section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO) shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from the Control Desk, Code 3200, Bldg. 222, Rm. 115, Naval Research Laboratory, 4555 Overlook Ave., S.W., Washington DC 20375-5326.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

L-6 DFARS 252.227-7017 - IDENTIFICATION AND ASSERTION OF USE, RELEASE, OR DISCLOSURE RESTRICTIONS (JUN 1995)

(a) The terms used in this provision are defined in following clause or clauses contained in this solicitation--

(1) If a successful offeror will be required to deliver technical data, the Rights in Technical Data--Noncommercial Items clause, or, if this solicitation contemplates a contract under the Small Business Innovative Research Program, the Rights in Noncommercial Technical Data and Computer Software--Small Business Innovative Research (SBIR) Program clause.

(2) If a successful offeror will not be required to deliver technical data, the Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation clause, or, if this solicitation contemplates a contract under the Small Business Innovative Research Program, the Rights in Noncommercial Technical Data and Computer Software--Small Business Innovative Research (SBIR) Program clause.

(b) The identification and assertion requirements in this provision apply only to technical data, including computer software documents, or computer software to be delivered with other than unlimited rights. For contracts to be awarded under the Small Business Innovative Research Program, the notification requirements do not apply to technical data or computer software that will be generated under the resulting contract. Notification and identification is not required for restrictions based solely on copyright.

(c) Offers submitted in response to this solicitation shall identify, to the extent known at the time an offer is submitted to the Government, the technical data or computer software that the Offeror, its subcontractors or suppliers, or potential subcontractors or suppliers, assert should be furnished to the Government with restrictions on use, release, or disclosure.

(d) The Offeror's assertions, including the assertions of its subcontractors or suppliers or potential subcontractors or suppliers shall be submitted as an attachment to its offer in the following format, dated and signed by an official authorized to contractually obligate the Offeror: Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software.

The Offeror asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data or computer software should be restricted:

Technical Data or Computer Software to be Furnished With Restrictions*	Basis for Assertion**	Asserted Rights Category***	Name of Person Asserting Restrictions****
(LIST)*****.	(LIST)	(LIST)	(LIST)

* For technical data (other than computer software documentation) pertaining to items, components, or processes developed at private expense, identify both the deliverable technical data and each such items, component, or process. For computer software or computer software documentation identify the software or documentation.

** Generally, development at private expense, either exclusively or partially, is the only basis for asserting restrictions. For technical data, other than computer software documentation, development refers to development of the item, component, or process to which the data pertain. The Government's rights in computer software documentation generally may not be restricted. For computer software, development refers to the software. Indicate whether development was accomplished exclusively or partially at private expense. If development was not accomplished at private expense, or for computer software documentation, enter the specific basis for asserting restrictions.

*** Enter asserted rights category (e.g., government purpose license rights from a prior contract, rights in SBIR data generated under another contract, limited, restricted, or government purpose rights under this or a prior contract, or specially negotiated licenses).

**** Corporation, individual, or other person, as appropriate.

***** Enter "none" when all data or software will be submitted without restrictions.

Date _____

Printed Name and Title _____

_____

Signature _____

(End of identification and assertion)

(e) An offeror's failure to submit, complete, or sign the notification and identification required by paragraph (d) of this provision with its offer may render the offer ineligible for award.
(f) If the Offeror is awarded a contract, the assertions identified in paragraph (d) of this provision shall be listed in an attachment to that contract. Upon request by the Contracting Officer, the Offeror shall provide sufficient information to enable the Contracting Officer to evaluate any listed assertion.

L-7 DFARS 252.227-7028 - TECHNICAL DATA OR COMPUTER SOFTWARE PREVIOUSLY DELIVERED TO THE GOVERNMENT (JUN 1995)

The Offeror shall attach to its offer an identification of all documents or other media incorporating technical data or computer software it intends to deliver under this contract with other than unlimited rights that are identical or substantially similar to documents or other media that the Offeror has produced for, delivered to, or is obligated to deliver to the Government under any contract or subcontract. The attachment shall identify - -

(a) The contract number under which the data or software were produced;
(b) The contract number under which, and the name and address of the organization to whom, the data or software were most recently delivered or will be delivered; and
(c) Any limitations on the Government's rights to use or disclose the data or software, including, when applicable, identification of the earliest date the limitations expire.

L-8 TRAVEL AND MATERIAL ESTIMATES - FOR EVALUATION PURPOSES ONLY

The travel and material set forth below must be included in each offeror's cost proposal. During the term of the contract, the contractor will be reimbursed actual and verifiable travel and material expenses.

a) The Government estimates the travel costs for this effort to be $20,000 for the basic contract.

b) The Government estimates the material costs for this effort to be $5,000 for the basic contract.

c) The travel and material estimates are direct costs and the offeror should add applicable indirect costs, if any.

L-9 INQUIRIES CONCERNING THE RFP

Any questions concerning the RFP must be submitted in writing to the Contracting Officer at the location noted in blocks 7 and 9 of the Standard Form 33, "Solicitation, Offer and Award," no less than fifteen (15) days before closing. The Government will not consider questions received after this date. Offerors are cautioned against directing any questions concerning this RFP to technical personnel at the Naval Research Laboratory.

L-10 INSTRUCTIONS FOR SUBMISSION AND INFORMATION REQUIRED TO EVALUATE PROPOSALS

(1) Information for the technical proposal shall be placed in Volume I and be completely separate from the business proposal (Volume II).

(2) Proposal Identification/Mailing - The proposal should be packaged for delivery so as to permit safe and timely arrival at destination. The proposal package should be sent to the address shown in Block 7 of the RFP face page and marked:

Solicitation No. N00173-01-R-MS01
Closing Date:
(As specified in Block 9, RFP face page)
Attn: Code 3220.MS

(3) Proposal Format and Length - No attempt is made to restrict the proposal format and style. However, the proposal should be written and organized so as to be compatible with the RFP, the Statement of Work, company's organization and accounting structure, and proposed cost estimate. Offerors are encouraged to use recycled paper and maximize the use of double sided copying when preparing responses to solicitations.

L-11 VOLUME I - TECHNICAL PROPOSAL

REQUIRED COPIES: 1 ORIGINAL AND 4 COPIES. (Paper Copies)

(1) Include a matrix indicating proposed labor hours by skill category required to perform the statement of work. This matrix shall not contain labor rates or any other indication of price.

(2) The following information is required for evaluation of your technical proposal:

TECHNICAL APPROACH (Options Evaluation)

Describe the technical approach including its technical risks and describe how the technical approach meets or exceeds the requirements in Section C-1. Describe the design-cost-performance trade-offs of the technical approach. Describe the survivability of Dragon Eye subsystems beyond the life of the airframe. Substantiate ability to meet the delivery dates including any ability to deliver ahead of the established delivery date. Describe how the technical approach minimizes the risk of late deliveries. Describe the ability and capacity in personnel and facilities to make large deliveries (*e.g.*, 250 Dragon Eye Systems).

TECHNICAL UNDERSTANDING (Basic Contract and Options Evaluation)

Explain understanding of the technology; what technological approaches will work to meet or exceed the requirements in Section C-1; and problems and risks associated with alternative approaches.

TECHNICAL EXPERTISE AND EXPERIENCE

(Basic Contract Evaluation)

Provide as qualifications: name; labor category (that coincides with the categories in Section H-3); education; expertise and experience required to accomplish Section C-1. Key personnel as defined in Section H-2 shall be identified as such.

(Options Evaluation)
Describe experience and expertise in the design and fabrication of complete Unmanned Aerial Vehicles (UAV) and subsystems similar to the complete Dragon Eye System. Describe experience and expertise in meeting schedules for delivery of complete systems similar to the Dragon Eye System that compare to the schedule and quantity requirements for options 1 through 8. Describe experience and expertise in the timely delivery of at least 250 complete systems similar to the Dragon Eye System. Provide description of experience and expertise of subcontractors relevant to these factors.

PAST PERFORMANCE INFORMATION (Options Evaluation)
(a) Offerors shall submit the following information as part of their proposal. (Offerors are encouraged to submit the information prior to other parts of the proposal to assist the government in reducing the length of the evaluation period.) List the last 5 contracts or subcontracts completed during the past 3 years for services similar in nature to this requirement. Include in the 5 any current contracts or subcontracts for similar services that were awarded at least one year prior to the date of this solicitation. Offerors should provide the requested information for predecessor companies, proposed subcontractors that will perform major or critical aspects of the requirement and for the proposed project manager or key personnel responsible for major or critical aspects of the requirement.

1. Name of contracting organization.
2. Contract number
3. Contract type
4. Total contract value
5. Description of the contract work
6. Contracting officer and telephone number
7. Contracting officer's representative, program manager, or similar official and telephone number

(b) Offerors shall contact the contracting organizations identified pursuant to paragraph (a) as soon as possible and request them to send past performance information on the identified contracts to the address in Block 7 of the face page of this solicitation. The past performance report which is available electronically in full text at http://heron.nrl.navy.mil/contracts/home.htm is to be provided to the contracting organization for this purpose. If the contracting organization has already collected past performance information on the contract pursuant to FAR Subpart 42.15, the format used to collect the information may be used instead of the past performance report.
(c) Offerors may include in their proposals specific information relating to problems encountered in performing the identified contracts and any corrective actions by the offeror. Offerors should not provide general information on their performance on the identified contracts as this will be obtained from the contracting organizations.

L-12 VOLUME II - BUSINESS PROPOSAL

REQUIRED COPIES: 1 ORIGINAL AND 4 COPIES (Paper Copies)

(1) COST PROPOSAL

The offeror shall submit a business proposal that includes a cost proposal with supporting information for each cost element consistent with offeror's cost accounting system. The supporting breakdown should include such elements as materials, direct labor, indirect cost, and other costs such as travel. The offeror shall provide exhibits as necessary to substantiate each cost element. Should rates be used in the proposal which are not DCAA approved, the offeror shall provide complete documentation and the rationale for their use at time of proposal submission. However, offerors are advised to use actual labor rates of proposed personnel as the basis for estimating labor costs when practicable.

L-13 MULTIPLE AWARDS

The Contracting Officer may make multiple awards resulting from this solicitation.

SECTION M
EVALUATION FACTORS FOR AWARD

M-1 EVALUATION

Award will be made to that offeror whose proposal is determined to be the best value to the Government, proposed cost and other factors considered. The Government reserves the right to make award to other than the low offeror. Although technical considerations are more important than the cost factor, the closer the technical scores of the various proposals are to one another, the more important the business considerations become.

M-2 EVALUATION FACTORS FOR AWARD

Proposals will be evaluated in accordance with the following criteria. The technical factor is more important than the cost factor. Factor (a) is more important than factors (b), (c), and (d). Factors (b) and (c) are of the same importance and more important than factor (d).

M-2-1. TECHNICAL

(A) TECHNICAL APPROACH (Options Evaluation)

Each Offeror will be evaluated on its proposed technical approach including the technical risks anticipated. Each Offeror will be evaluated on the design-cost-performance trade-offs of its technical approach. Survivability of Dragon Eye subsystems beyond the life of the airframe will be given weight. Each offeror will be evaluated on the ability to meet the delivery dates. Ability to deliver ahead of the established delivery date will be given weight. Also, a technical approach that minimizes the risk of late deliveries will be given weight. Each offeror will be evaluated on its capacity in personnel and facilities to make large deliveries (*e.g.*, 250 Dragon Eye Systems).

(B) TECHNICAL UNDERSTANDING (Basic Contract/Option Evaluation)

Each Offeror will be evaluated on its understanding of the technology. The Offeror will be evaluated on its understanding of: what technological approaches will and will not work to meet or exceed the requirements in Section C-1, and what problems and risks are associated with alternative approaches.

(C) TECHNICAL EXPERTISE AND EXPERIENCE

(Basic Contract Evaluation)
The Offeror will be evaluated on the qualifications of personnel that it either has, or has the ability to obtain, with regard to performance of Section C-1.

(Options Evaluation)
The Offeror will be evaluated on its experience and expertise in the design and fabrication of Unmanned Aerial Vehicles (UAV) and subsystems similar to the complete Dragon Eye Systems. The Offeror will be evaluated on its experience and expertise in fabrication of complete systems similar to the Dragon Eye System. The Offeror will be evaluated on its experience and expertise in meeting delivery schedules for complete systems similar to the Dragon Eye System. The Offeror will be evaluated on its experience and expertise in the timely delivery of at least 250 complete systems similar to the Dragon Eye System. The Offeror will be similarly evaluated on the experience and expertise of any subcontractors the Offeror included in its proposal.

(D) PAST PERFORMANCE (Options Evaluation)

Past performance will be evaluated on the basis of the quality of the work performed, timeliness of performance, cost control, and business relations. The evaluation will be based on the information provided pursuant to Section L and other sources if available. Offerors will be evaluated on the currency and relevance of the past performance information, the source of the information, context of the data, and general trends in the Offeror's performance. Offerors also will be evaluated based on personnel qualifications in the proposal. The evaluation may take into account past performance information regarding predecessor companies or subcontractors that will perform major or critical aspects of the requirement. Offerors that have no relevant performance history or for which past performance information is not available will not be evaluated favorably or unfavorably on past performance. The government may begin proposal evaluation prior to receipt of past performance information. If, after completion of proposal evaluation except evaluation of past performance, the contracting officer determines that evaluation of past performance will not affect the outcome of competitive selection, the contracting officer may waive its evaluation in accordance with FAR 15.304(c)(3)(iv).

M-2-2 COST TO THE GOVERNMENT

The Government will consider the overall cost and cost realism.

Overall cost includes the Offeror's proposed cost and fixed fee. The Government will consider the effective utilization of allocated funds. Cost estimates should be reasonable and realistic for ensuring successful completion of the Dragon Eye Systems within the specified periods of performance.

The Government may adjust the proposed overall cost for purposes of evaluation based upon the results of a cost realism evaluation. Cost realism includes an analysis of the adequacy of the hours, labor mix, materials, supporting cost in the business proposal, and direct costs to perform the work as proposed. Also considered is cost realism of the proposed labor and indirect rates. Cost realism includes an evaluation of the likelihood that the risks inherent in the Offeror's technical approach will result in higher actual costs than anticipated. Cost realism analysis requires accurate, factual, verifiable, and predictable data relative to what costs would most likely be incurred to provide the required services and deliverables utilizing the Offeror's technical approach.

M-3 FAR 52.217-5 - EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

STATEMENT OF WORK
Dragon Eye, Robotic Airborne Sensor System

1.0 INTRODUCTION

The Dragon Eye Program is being conducted in direct response to a Secretary of the Navy Initiative to enhance the over-the-hill reconnaissance capability of United States Marine Corps (USMC) Small Units. The Dragon Eye concept is a man-portable, robotic airborne sensor system that provides real-time video imagery to a wearable ground control station. The operation of this system is organic to the Small Unit, and the system is therefore independently and individually deployed.

2.0 BACKGROUND

Functional developmental Dragon Eye Systems are being developed and demonstrated by the Naval Research Laboratory (NRL) and the Marine Corps Warfighting Laboratory (MCWL). Initial field experiments with Marine Expeditionary Forces (MEF) have been performed and will continue through Fiscal Year (FY) 2002. In order to support the planned level of MEF experimentation, between ten (10) and eighty (80) additional Dragon Eye Systems are required no later than January 2002. An overview of the Dragon Eye Program, including goals and schedule, is provided as Attachment 3, Dragon Eye Project Description.

3.0 SCOPE

3.1 Base performance. The contractor shall provide the engineering support (Contract Line Item Number) (CLIN) 0001) to NRL for the prototype Dragon Eye System development. Engineering support includes the design, layout, fabrication, assembly, integration, checkout, and operation of the Dragon Eye System.

3.2 Optional performance. The contractor shall fabricate, integrate, assemble, test, and deliver the entire Dragon Eye System under Options 1-12 (CLINs 0003-0042). Options 1-8 include 10 Dragon Eye Systems each; Options 9-12 include up to 40 Ground Control Stations (GCS) and 250 Air Vehicles each.

3.3 Dragon Eye System requirements. The contractor shall minimize the cost to fabricate, integrate, assemble, test, and deliver Dragon Eye Systems in Options 1-8 (CLINs 0003-0026). The contractor shall meet the design in Attachment 2 pages 2, 5, 6, and 7 (the Dragon Eye characteristics and packaging; and the Dragon Eye side, front, and top views). The airframe must meet the size and shape of the molds provided in Section 5.0. The contractor shall meet or exceed the schedule goals in Attachment 3,

Dragon Eye Project Description. The contractor shall meet or exceed the performance and technical requirements in Section 4.0. The contractor may improve Dragon Eye System characteristics including reduced weight, improved durability, communication links, sensor resolution and flight performance. Attachment 6, Industry Brief, provides acceptable examples of many Dragon Eye System components.

3.4 Contractor requirements. The contractor shall have the capability to act as the prime to direct quantity Dragon Eye System delivery in Options 9-12 (CLINs 0027-0042). The contractor shall have the capability to provide logistics support for all delivered Dragon Eye Systems in Options 9-12.

4.0 PERFORMANCE AND TECHNICAL REQUIREMENTS

4.1 Elements of each Dragon Eye System. The Dragon Eye System must be capable of operating in arctic, tropical, and desert environments. The Government may change the quantity of any Dragon Eye System element. A Dragon Eye System, at a minimum, must consist of:

4.1.1. two (2) Dragon Eye air vehicles;

4.1.2 four (4) interchangeable payload noses, each containing a color daylight imager;

4.1.3 two (2) interchangeable payload noses, each containing a monochrome low light or a thermal IR imager;

4.1.4 two (2) Modular Lightweight Load-Carrying (MOLLE) vest-compatible backpack storage containers [for the above items];

4.1.5 four (4) Nickel Metal Hydride (NiMH) rechargeable battery packs;

4.1.6 four (4) Lithium Sulfur Dioxide ($LiSO_2$) primary battery packs;

4.1.7 one (1) Field Support Kit; and;

4.1.8. one (1) Ground Control Station (GCS) equipped with communication links.

4.2 Air vehicle design. The air vehicle is the airframe with all its incorporated components and subsystems.

4.2.1 Configuration, propulsion, power and actuators. The air vehicle must be a plank-type flying wing configuration with twin propellers driven by brushless direct-current (DC) electric motors. The twin propellers must counter-rotate to cancel torque effects. The motors must be wing-mounted to enable a clear camera view forward, sideways, and down from the payload nose. The battery pack must power all air vehicle subsystems. The airframe must contain two servoactuators for control surface actuation.

4.2.2 Assembly/disassembly. The Dragon Eye air vehicle must disassemble into no more than 5 pieces (2 wing panels, center section, tail, and payload nose). Assembly and disassembly of the air vehicle must be accomplished by hand without tools.

4.2.3 Materials. Airframe materials may include, but are not limited to, fiberglass, Kevlar (brand name or equal), carbon fiber, balsa wood, Rohacell (brand name or equal) foam, Nomex (brand name or equal) honeycomb core, aircraft plywood, and aluminum.

4.2.4 Payload noses. Payload noses must directly interface with the airframe both mechanically and electronically and must be completely interchangeable between airframes. Payload variations must include forward looking, side looking, and down looking installations of: a daylight camera; and a lowlight or an Infrared (IR) camera installed in noses.

4.3 Weight. The air vehicle's mission-ready gross weight must be approximately four and a half (4.5) pounds or less. The Government's goal is four (4) pounds.

4.4 Durability. The airframe must have a lifetime of at least 20 one hour missions under normal tactical operating conditions, including arctic, tropical, and desert conditions.

4.5 Communication links.

4.5.1 Line-of-sight range. The communication uplink (from the GCS) and downlink (from the air vehicle) must meet or exceed a radio frequency (RF) line-of-sight range of ten (10) kilometers.

4.5.2 Communication links. The communication links must be compatible with the software and protocols of the onboard avionics as well as the Dragon Eye GCS. Both the uplink and downlink air vehicle antennas must be internal or conformal with the airframe.

4.5.2.1 Uplink. The communication link transmitter must provide an uplink of Global Positioning System (GPS) waypoint commands via an RS232 interface. A 9600 bits per second (bps) autopilot command data uplink must be provided.

4.5.2.2 Downlink. The communication link transmitter must provide downlink of payload video. The communication downlink must support National Television System Committee (NTSC) composite video from the payload camera to the Ground Control System (GCS). The downlink must also support at least 4800 bps telemetry data. There is no audio downlink requirement, therefore the NTSC audio subcarrier may be used for the data downlink.

4.5.2.3 Frequency range. The uplink and downlink radios must operate in the military frequency band(s) that are recommended in a study being conducted by the Joint Spectrum Center. Potential frequency bands are listed on page 37, Attachment 6, Industry Brief.

4.6 Cameras and lenses. The contractor shall provide the cameras and lenses identified in pages 29-33, Attachment 6, Industry Brief (brand name or equal), or cameras and lenses with superior characteristics. .

4.7 Flight performance. The flight endurance of the Dragon Eye air vehicle must be at least 15 minutes with a rechargeable NiMH battery pack, and at least 60 minutes with a $LiSO_2$ battery pack. The air vehicle shall meet or exceed this flight endurance at airspeeds of 35 to 40 knots at standard sea level conditions. The air vehicle must be capable of operation at density altitudes up to 8000 feet. The air vehicle must be capable of hand launch. The air vehicle must perform an autonomous landing maneuver.

4.8 Autopilot. The autopilot must enable fully autonomous flight using GPS for navigation, and must be reprogrammable in flight to adjust navigation waypoints. In addition, the autopilot must provide a sufficiently stable flight path for imaging.

4.9 Ground equipment.

4.9.1 Ground Control System.

4.9.1.1 Hardware. The Dragon Eye GCS is based on an NRL-developed wearable Pentium computer, the End User Terminal Plus (EUT+). The contractor shall modify the EUT+ only to provide RF line-of-sight communication links. In addition to modifying one EUT+ provided as Government Furnished Equipment (GFE), the contractor shall provide kits to modify an additional nine EUT+s in Option 1 (CLIN 0003).

4.9.1.2 Software. The contractor shall use the government off-the-shelf (GOTS) software in the EUT+, which supports displays including imagery and telemetry transmitted from the air vehicle, and a moving map that tracks the air vehicle's location.

4.9.2 Air Vehicle Containers: The air vehicle must disassemble into a volume of fifteen (15) inches X by fifteen (15) inches X by seven (7) inches. The air vehicle containers must be sufficiently rugged to allow MOLLE-compatible transport without damage during military operations, while being as lightweight and compact as possible. Each container must hold one Dragon Eye air vehicle five (5) pieces and two (2) additional payload noses.

4.9.3 Field support kit: The field support kit must include items needed for routine operations plus materials for minor field repair. The field support kit must include a flight battery charger, fast setting epoxy glue, adhesive tapes, cutting tools and small hand tools, all within a small, rugged container that is MOLLE-vest compatible.

5.0 GOVERNMENT FURNISHED EQUIPMENT

Government Furnished Equipment (GFE) is provided for Option 1 only. Items 5.3 and 5.4 shall be installed in the Dragon Eye Systems. At the end of Option 1, the contractor shall return items 5.2 and 5.5. The following items will be provided:

5.1 Drawing and data package detailing:

5.1.1 components requiring fabrication, including critical dimensions, tolerances, and lamination schedules for composite materials;

5.1.2 interrelationships of all components;

5.1.3 wiring diagrams;

5.1.4 functional block diagrams;

5.1.5 materials list;

5.1.6 COTS components source list; and

5.1.7 notes that describe critical aspects and requirements for fabrication, assembly, integration and checkout.

5.2 One (1) set of tooling and molds for the airframe.

5.3 Two (2) brushless DC Electric Propulsion Motors with associated gearboxes and sensorless controllers for each airframe.

5.4 One (1) GPS-based autopilot with navigator for each airframe.

5.5 One (1) EUT+ with GOTS software.

6.0 DATA DELIVERABLES

6.1 Monthly Reports. Monthly letter-type progress reports shall be provided throughout the period of performance.

6.2 Interim Report. The interim report must include overall details describing the contractor's effort, problems encountered and their solutions, recommendations for improvements and/or modifications to the Dragon Eye System or subsystems which will improve producability, improve performance, or reduce cost. The contractor shall provide to NRL the transmitter and receiver equipment information needed to submit the DD FORM 1494, Application for Equipment Frequency Allocation. The interim report must also include a plan and cost estimate for the delivery of up to one hundred (100) additional Dragon Eye systems (including suggested improvements) within the next twelve (12)-month period without use of GFE. In addition, the interim report must address parameters and cost/schedule estimates for volume delivery beginning FY 2003-2004.

6.3 Final Report. The final report shall be delivered no later than 30 days after completion of contract. The final report must include overall details describing the contractor's effort, problems encountered and their solutions, recommendations for improvements and/or modifications to the Dragon Eye System or subsystems which will improve producability, improve performance, or reduce cost.

CONTRACT DATA REQUIREMENTS LIST

Form Approved
OMB No. 0704-0188

A. CONTRACT LINE ITEM NO.	B. EXHIBIT	C. CATEGORY:
See Remarks, BLK. 16	A	TDP _____ TM _____ OTHER _____

D. SYSTEM / ITEM	E. CONTRACT / PR NO.	F. CONTRACTOR
	N00173-01-R-MS01	

Block 1

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
A001	Montlhy Progress Report	

4. AUTHORITY (Data Acquisition Document No.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
N/A	SOW Paragraph 6.1	NRL Code 5712

7. DD 250 REQ	8. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
LT		MTHLY	30 DAC
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**
N/A	N/A		EOM

16. REMARKS

Block A. Contract Line Item Numbers, 0002, 0005, 0008, 00011, 0014, 0017, 0020, 0023, 0026, 0030, 0034, 0038, 0042

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES		
	Draft	Final Reg	Final Repro
NRL Code 5712		1	
15. TOTAL →		1	

17. PRICE GROUP

18. ESTIMATED TOTAL PRICE

Block 2

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
A002	Interim Report	

4. AUTHORITY (Data Acquisition Document No.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
N/A	SOW Paragraph 6.2	NRL Code 5712

7. DD 250 REQ	8. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
NO		SEE BLK 16	SEE BLK 16
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**
N/A	N/A		

16. REMARKS

Block 10. Interim Report is required 30 days after final delivery of each option, if exercised.

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES		
	Draft	Final Reg	Final Repro
NRL Code 5712		1	
15. TOTAL →		1	

17. PRICE GROUP

18. ESTIMATED TOTAL PRICE

Block 3

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE
A003	Final Report	

4. AUTHORITY (Data Acquisition Document No.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
N/A	SOW Paragraph 6.3	NRL Code 5712

7. DD 250 REQ	8. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
DD		1TIME	EOC
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**
N/A	N/A	See BLK 16	

16. REMARKS

Block 12: Final Report is due no later than 30 days after contract completion.

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES		
	Draft	Final Reg	Final Repro
NRL Code 5712		1	
DTIC		1	
15. TOTAL →		2	

17. PRICE GROUP

18. ESTIMATED TOTAL PRICE

Block 4

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE

4. AUTHORITY (Data Acquisition Document No.)	5. CONTRACT REFERENCE	6. REQUIRING OFFICE

7. DD 250 REQ	8. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**

16. REMARKS

14. DISTRIBUTION

a. ADDRESSEE	b. COPIES		
	Draft	Final Reg	Final Repro
15. TOTAL →			

17. PRICE GROUP

18. ESTIMATED TOTAL PRICE

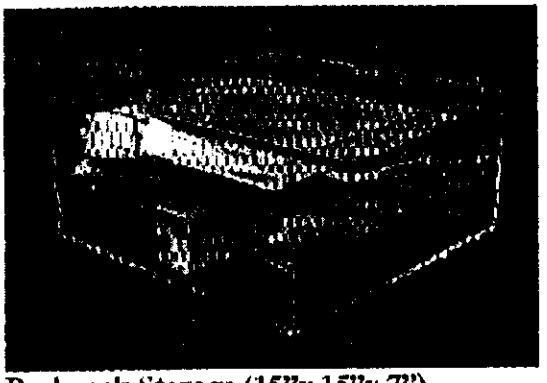
G. PREPARED BY	H. DATE	I. APPROVED BY	J. DATE
Code 5712			

REQUIREMENTS AND PERFORMANCE SPECIFICATIONS

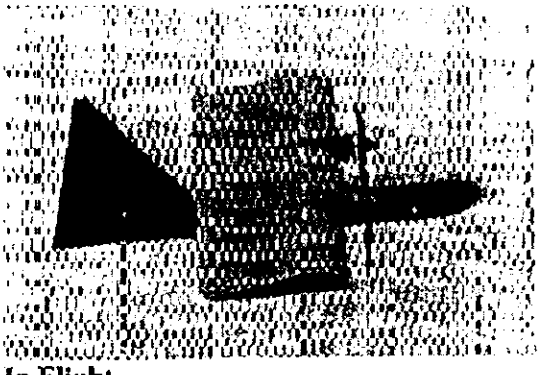
Dragon Eye

Characteristics:	
Gross Weight	4.4 lb
Payload Weight	.85 lb (incl. link)
Battery Weight	1.4 lb
Wing Span	45.0 in
Wing Chord	12.0 in
Aspect Ratio	3.75
Wing Area	3.75 sq ft
Wing Loading	1.29 lb/sq ft
Airfoil	Liebeck 2573A (mod)
Center of Gravity	16% -18% m.a.c.
Fuselage Length	35.5 in
Overall Height	10.5 in
Cruise Airspeed	35 - 40 kt
Stall Airspeed	19 kt
Unfolded Propeller Diameter	9.75 in
Max. Battery Power	300 watt
Cruise Battery Power	120 watt
Payload & Avionics Power	10 watt
Endurance (rechargeable)	15 min (NiMH)
Endurance (non-rechargeable)	60 min (LiSO2)
Deployment	Hand Launched
Recovery	Deep Stall
Flight Controls	Elevons & Throttle on 2 DC Electric Motors

Packaging:	
Nose	2.4"x 8.5"x 3"
Fuselage-Wing	15"x 15"x 5"
Tail	10.5"x 12"x 2.4"
Wing Outer Sections	15"x 12"x 1.5"

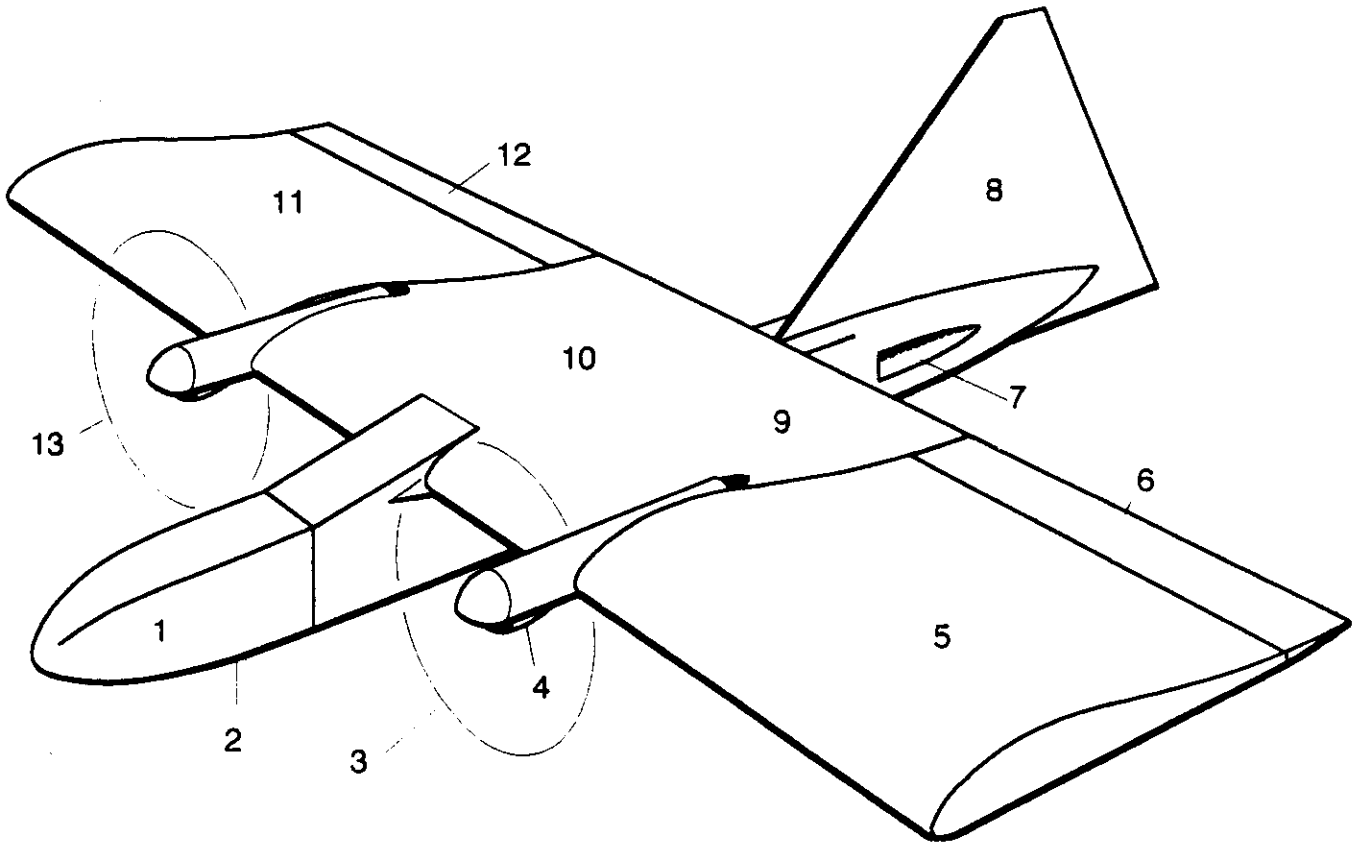


Backpack Storage (15"x 15"x 7")



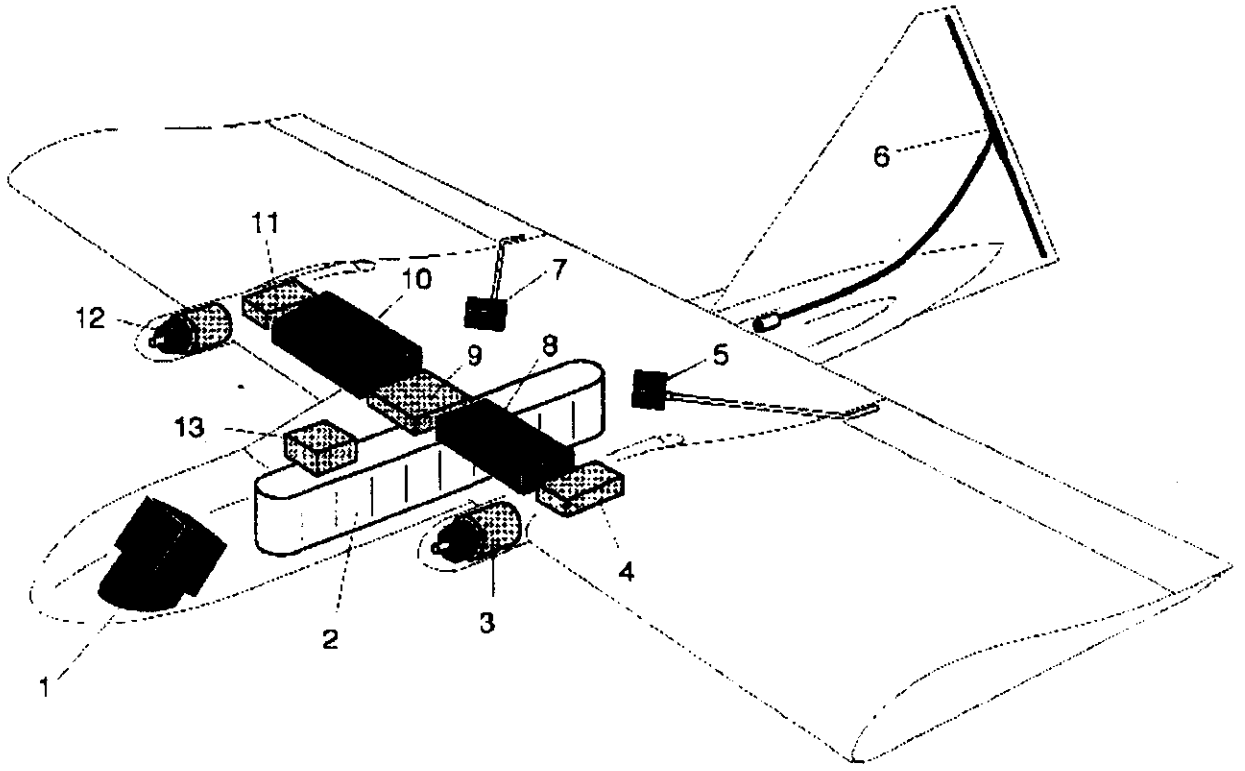
In Flight

DRAGON EYE
AIRFRAME COMPONENTS



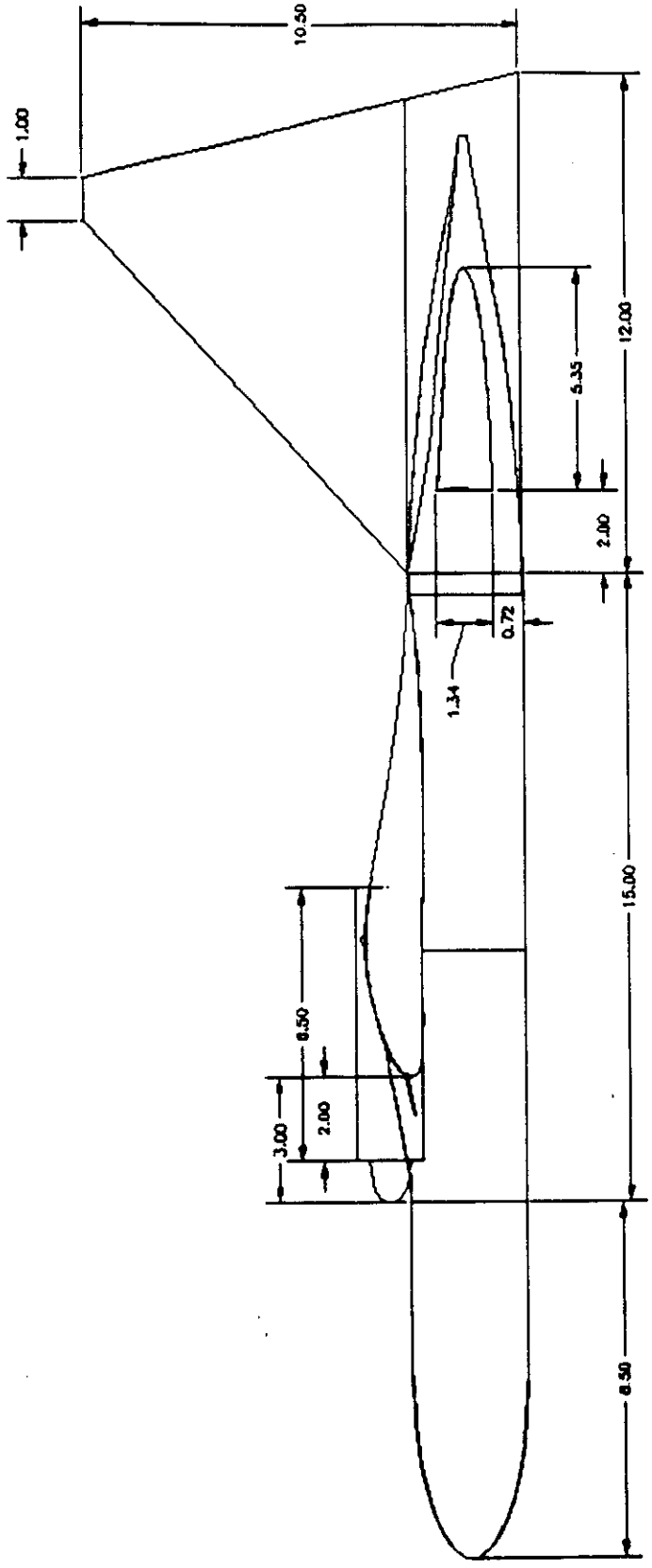
1. INTERCHANGEABLE NOSE W/ MISSION PAYLOAD
2. BATTERY COOLING AIR INLET, NOSE UNDERSIDE
3. FOLDING PROPELLER, LEFT-HAND ROTATION
4. MOTOR & CONTROLLER COOLING AIR INLET
5. LEFT OUTER WING PANEL
6. LEFT ELEVON
7. BATTERY COOLING AIR OUTLET
8. VERTICAL TAIL / FUSELAGE TAILCONE ASSEMBLY
9. COOLING AIR OUTLET
10. AIRFRAME CENTER SECTION / FUSELAGE ASSEMBLY
11. RIGHT OUTER WING PANEL
12. RIGHT ELEVON
13. FOLDING PROPELLER, RIGHT-HAND ROTATION

DRAGON EYE
SUBSYSTEMS



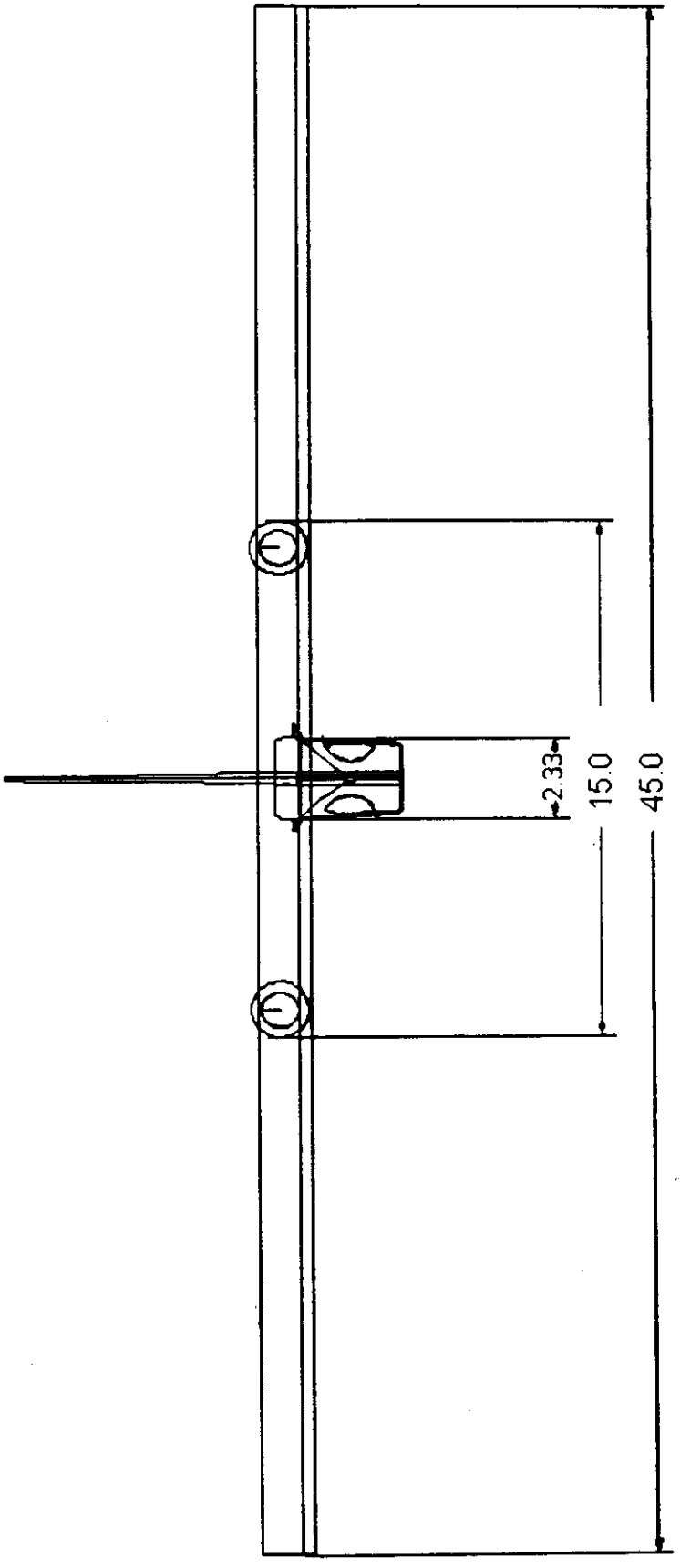
1. IMAGER PAYLOAD
2. PRIME POWER BATTERY PACK
3. BRUSHLESS DC MOTOR & GEARBOX
4. SENSORLESS MOTOR CONTROLLER
5. LEFT ELEVON SERVO ACTUATOR
6. DIPOLE ANTENNA
7. RIGHT ELEVON SERVO ACTUATOR
8. COMMUNICATION LINK SYSTEM
9. DC - DC VOLTAGE CONVERTER
10. AUTOPILOT & GPS NAVIGATOR FCS
11. SENSORLESS MOTOR CONTROLLER
12. BRUSHLESS DC MOTOR & GEARBOX
13. FCS AIR DATA SENSORS

Dragon Eye



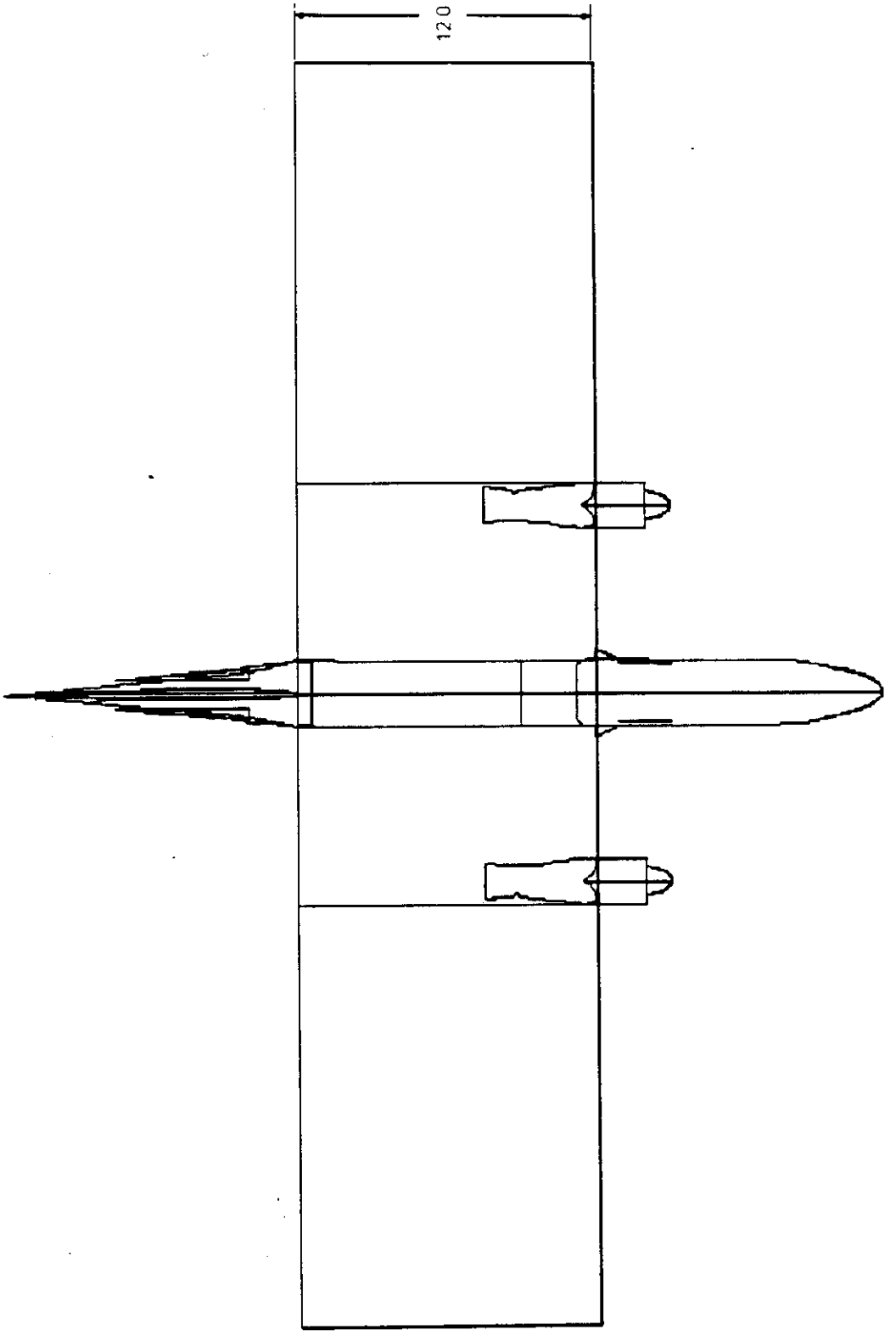
Dragon Eye Side View: Not to scale, all units in inches.

Dragon Eye



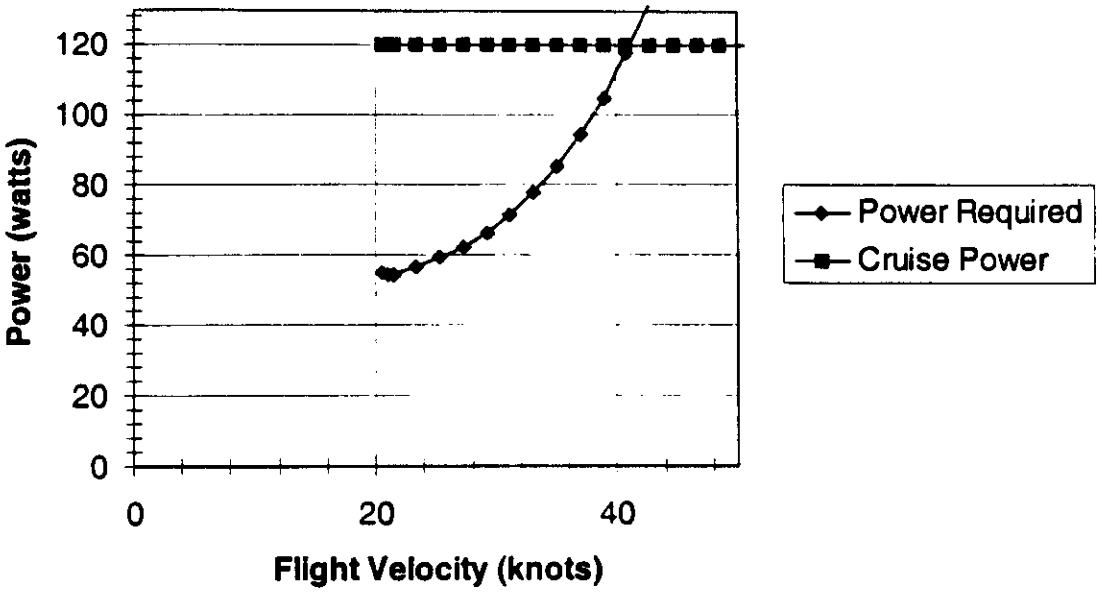
Dragon Eye Front View: Not to scale, all units in inches.

Dragon Eye

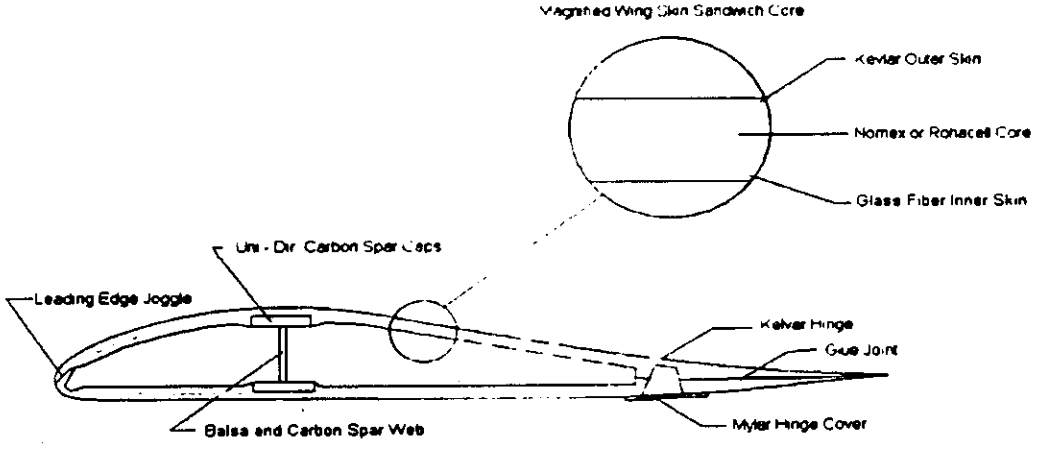


Dragon Eye Top View: Not to scale, all units in inches.

Dragon Eye



Steady Level Flight Performance



Typical Dragon Eye Composite Structures

Dragon Eye Project Description

1. Background Narrative – Dragon Eye is a robotic airborne sensor system that is intended to provide threat detection and reconnaissance capabilities to the USMC Small Unit. Dragon Eye consists of a man-portable, multi-role, 2 kg, hand-launched fixed wing air vehicle, and a wearable Ground Control Station (GCS) to provide control of, and receive intelligence from, the air vehicle. The vehicle characteristics enable an operational capability in adverse weather conditions. Dragon Eye features autonomous flight capability to allow one-person operation, with recovery via an autopilot-commanded deep stall terminal descent. The endurance goal is 60 minute (min) at 35 knot (kt) airspeed, with an electric propulsion system. Interchangeable, 1 pound (LB), modular, commercial off-the-shelf components payloads for Dragon Eye include daylight, low light, and infrared imaging systems. Government Off the Shelf (GOTS) Software has been developed to provide a Command-Control and Sensor display capability. This software runs on the Pentium based wearable Ground Control Station. The Dragon Eye GCS is a variant of the EUT+ (End User Terminal, Plus), a ruggedized wearable computer configured on a Modular Lightweight Load-Carrying Equipment (MOLLE) vest equipped with a ruggedized monitor for moving map, video display and touch screen interface.

2. Mission – Dragon Eye is in direct response to the SECNAV Over-The-Hill Reconnaissance Initiative, which is geared to respond to stated and published warfighter requirements. This includes both Naval requirements and also the nearly mirror-image requirements of the Marine Corps as embodied in the Marine Corps' Interim Small Unit Remote Scouting System (ISURSS) requirement, and, further, the Marine Corps "over the hill/ over the next building" reconnaissance, surveillance, and target acquisition (OTH RSTA) requirement. Dragon Eye supports the highest priority mission for Small Unmanned Aerial Vehicles (UAVs): OTH RSTA by Small Units (Company sized and below). It will be an organic asset that will allow the user to establish mission priority. It will provide payload data directly to the Small Unit, affording an unprecedented level of situational awareness. Dragon Eye will be used by Small Units, and is not currently intended to be a sensor platform which will directly contribute to the common tactical picture.

3. Goals – The goals for the Dragon Eye Project are to develop and deliver a close-in reconnaissance airborne sensor system to the warfighter and to position that low cost system for limited volume production. The time scale for Project completion is three years from the March 2000 start, or March 2003. Developmental goals include delivery of a number of full capability, residual systems for ongoing warfighter experimentation.

4. System – Each Dragon Eye System consists of two (2) Dragon Eye air vehicles, four (4) interchangeable payload noses each containing a color daylight imager; two (2) interchangeable payload noses each containing a monochrome low light or IR imager; four (4) NiMH rechargeable battery packs (15 min endurance each); four (4) $LiSO_2$ primary battery packs (60 min endurance each); two (2) MOLLE-vest- compatible back-pack storage containers [for the above items]; and, one (1) Ground Control Station equipped with a 10 km range GCS-to-air-vehicle communication link.

5. Schedule – As shown in Fig.1 below, industry involvement for fabrication and delivery of full-up Dragon Eye airborne sensor systems is nominally scheduled to begin on 2 Feb 2001. The production of these systems will occur following initial warfighter input from an ongoing series of limited objective experiments which are scheduled throughout the Project.

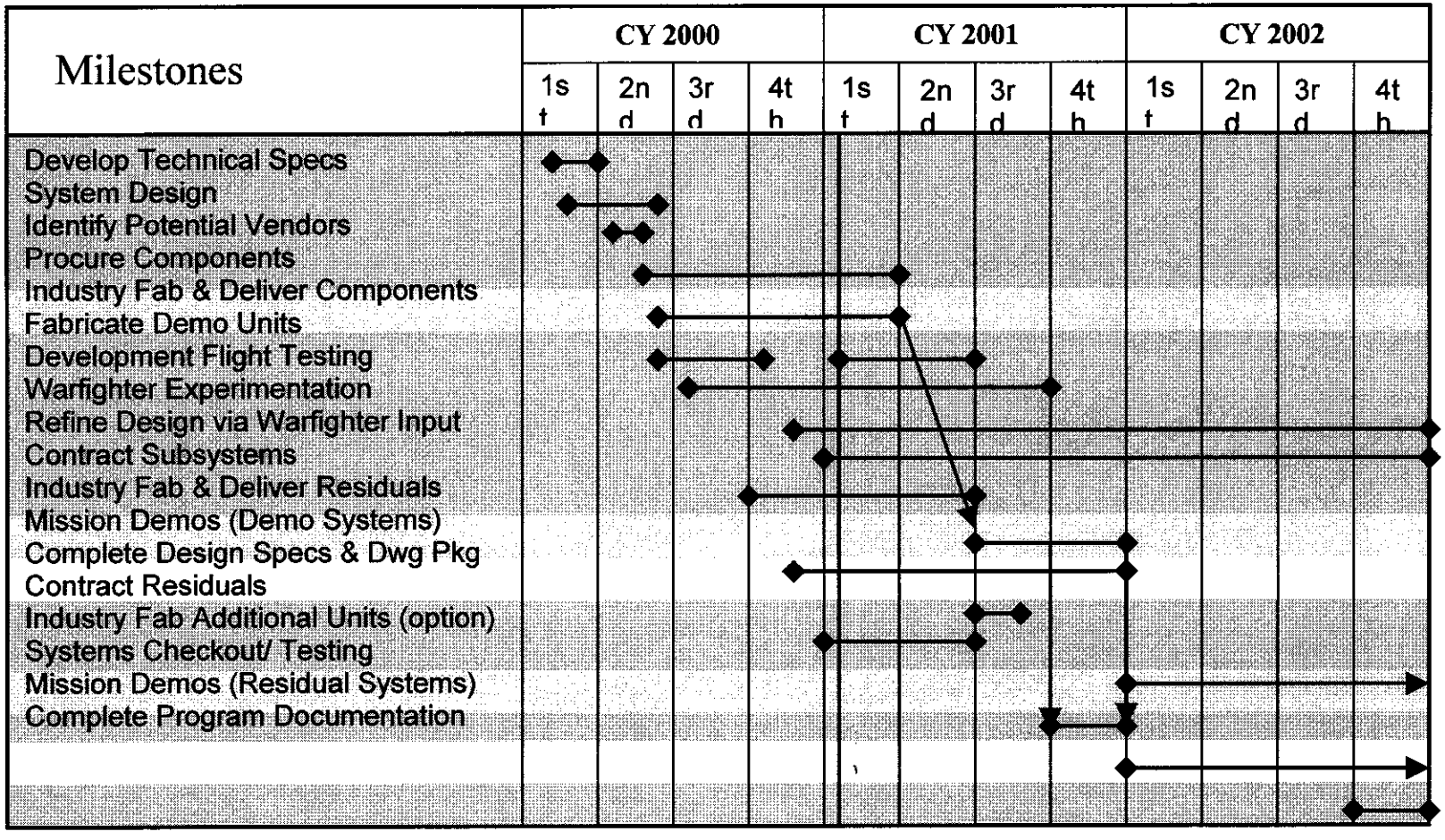


Figure One. Dragon Eye CY00-CY02 Milestone Chart.

Personnel Qualifications

1. LABOR CATEGORY: Senior Engineer (1)

Education: A Bachelor of Science (BS) degree in aerospace engineering, mechanical engineering, electrical engineering, or systems engineering is required. Five years of experience in the development and flight testing of unmanned, remotely piloted aircraft or small manned aircraft can be substituted for the degree.

Experience: Five years experience as the lead engineer for the development, fabrication and testing of flight-worthy, small remotely-piloted unmanned aircraft, or small manned aircraft and their systems.

2. LABOR CATEGORY: Electronics Engineering Technician (1)

Experience: Ten years experience in hands-on support of the development, fabrication, testing and trouble shooting of remotely-piloted unmanned aircraft avionics, including the following onboard systems: prime electrical power, guidance and control electronics, communications link hardware, flight data sensors, and electro-optical sensors.

3. LABOR CATEGORY: Mechanical Engineering Technician (1)

Experience: Five years experience in hands-on support of the development, fabrication, maintenance, and repair of advanced composite airframe structures for remotely-piloted unmanned aircraft or manned aircraft, including: fiberglass/epoxy, Kevlar/epoxy, carbon fiber/epoxy materials, vacuum bagged room-temperature cured lay-ups, metal structural fittings, and component interfaces.

DEPARTMENT OF DEFENSE
CONTRACT SECURITY CLASSIFICATION SPECIFICATION

(The requirements of the DoD Industrial Security Manual apply to all security aspects of this effort.)

1. CLEARANCE AND SAFEGUARDING SER: 004-01

a. FACILITY CLEARANCE REQUIRED: SECRET

b. LEVEL OF SAFEGUARDING REQUIRED: NONE

2. THIS SPECIFICATION IS FOR: *(X and complete as applicable)*

	a. PRIME CONTRACT NUMBER	
	b. SUBCONTRACT NUMBER	
X	c. SOLICITATION OR OTHER NUMBER: 57-1146-01	DUE DATE *(YYYYMMDD)*

3. THIS SPECIFICATION IS: *(X and complete as applicable)*

X	a. ORIGINAL *(Complete date in all cases)*		DATE *(YYYYMMDD)*: 20010119
	b. REVISED *(Supersedes all previous specs)*	REVISION NO.	DATE *(YYYYMMDD)*
	c. FINAL *(Complete item 5 in all cases)*		DATE *(YYYYMMDD)*

4. IS THIS A FOLLOW-ON CONTRACT? [ ] YES [X] NO. If Yes, complete the following:

Classified material received or generated _____ *(Preceding Contract Number)* is transferred to this follow-on contract.

5. IS THIS A FINAL DD FORM 254? [ ] YES [X] NO. If Yes, complete the following:

In response to the contractor's request _____, retention of the classified material is authorized for the period of _____

6. CONTRACTOR *(Include Commercial and Government Entity (CAGE) Code)*

a. NAME, ADDRESS, AND ZIP CODE	b. CAGE CODE	c. COGNIZANT SECURITY OFFICE *(Name, Address, and Zip Code)*
FOR RFP PURPOSES ONLY, NOT VALID FOR ACTUAL CONTRACT AWARD		N/A

7. SUBCONTRACTOR

a. NAME, ADDRESS, AND ZIP CODE	b. CAGE CODE	c. COGNIZANT SECURITY OFFICE *(Name, Address, and Zip Code)*
N/A		N/A

8. ACTUAL PERFORMANCE

a. LOCATION	b. CAGE CODE	c. COGNIZANT SECURITY OFFICE *(Name, Address, and Zip Code)*
N/A		N/A

9. GENERAL IDENTIFICATION OF THIS PROCUREMENT

DRAGON EYE, ROBOTIC AIRBORNE SENSOR SYSTEM

10. CONTRACTOR WILL REQUIRE ACCESS TO:	YES	NO
a. COMMUNICATIONS SECURITY (COMSEC) INFORMATION		X
b. RESTRICTED DATA		X
c. CRITICAL NUCLEAR WEAPON DESIGN INFORMATION		X
d. FORMERLY RESTRICTED DATA		X
e. INTELLIGENCE INFORMATION		
(1) Sensitive Compartmented Information (SCI)		X
(2) Non-SCI		X
f. SPECIAL ACCESS INFORMATION		X
g. NATO INFORMATION		X
h. FOREIGN GOVERNMENT INFORMATION		X
i. LIMITED DISSEMINATION INFORMATION		X
j. FOR OFFICIAL USE ONLY INFORMATION		X
k. OTHER *(Specify)*		

11. IN PERFORMING THIS CONTRACT, THE CONTRACTOR WILL:	YES	NO
a. HAVE ACCESS TO CLASSIFIED INFORMATION ONLY AT ANOTHER CONTRACTOR'S FACILITY OR A GOVERNMENT ACTIVITY	X	
b. RECEIVE CLASSIFIED DOCUMENTS ONLY		X
c. RECEIVE AND GENERATE CLASSIFIED MATERIAL		X
d. FABRICATE, MODIFY, OR STORE CLASSIFIED HARDWARE		X
e. PERFORM SERVICES ONLY		X
f. HAVE ACCESS TO U.S. CLASSIFIED INFORMATION OUTSIDE THE U.S., PUERTO RICO, U.S. POSSESSIONS AND TRUST TERRITORIES		X
g. BE AUTHORIZED TO USE THE SERVICES OF DEFENSE TECHNICAL INFORMATION CENTER (DTIC) OR OTHER SECONDARY DISTRIBUTION CENTER		X
h. REQUIRE A COMSEC ACCOUNT		X
i. HAVE TEMPEST REQUIREMENTS		X
j. HAVE OPERATIONS SECURITY (OPSEC) REQUIREMENTS		X
k. BE AUTHORIZED TO USE THE DEFENSE COURIER SERVICE		X
l. OTHER *(Specify)*		

12. PUBLIC RELEASE. Any information *(classified or unclassified)* pertaining to this contract shall not be released for public dissemination except as provided by the Industrial Security Manual or unless it has been approved for public release by appropriate U.S. Government authority. Proposed public releases shall

[ ] Direct [X] Through *(Specify)*

COMMANDING OFFICER, NAVAL RESEARCH LABORATORY, WASHINSGTON, DC 20375-5320, CODE 5712.

to the Directorate for Freedom of Information and Security Review, Office of the Assistant Secretary of Defense (Public Affairs)* for review.
*In the case of non-DoD User Agencies, requests for disclosure shall be submitted to that agency.

13. SECURITY GUIDANCE. The security classifiection guidance needed for this classified effort is identified below. If any difficulty is encountered in applying this guidance or if any other contributing factor indicates a need for changes in this guidance, the contractor is authorized and encouraged to provide recommended changes; to challenge the guidance or the classification assigned to any information or material furnished or generated under this contract; and to submit any questions for interpretation of this guidance to the official identified below. Pending final decision, the information involved shall be handled and protected at the highest level of classification assigned or recommended. *(Fill in as appropriate for the classified effort. Attach, or forward under*

ACCESS TO CLASSIFIED INFORMATION IS NOT REQUIRED FOR THE PURPOSE OF SUBMITTING A BID/PROPOSAL FOR THIS STATEMENT OF WORK. HOWEVER, PRIOR TO AWARD OF CONTRACT, THE SUCCESSFUL CONTRACTOR WILL BE REQUIRED TO HAVE A SECRET FACILITY CLEARANCE, AND PERSONNEL AVAILABLE WITH DOD GRANTED PERSONNEL SECURITY CLEARANCES COMMENSURATE WITH LEVEL OF ACCESS REQUIRED FOR PERFORMANCE OF CONTRACT.

2001 JAN 23 P 1:07
CONTRACTS
DIVISION

14. ADDITIONAL SECURITY REQUIREMENTS. Requirements, in addition to ISM requirements, are established for this contract. [ ] Yes [X] No
(If Yes, identify the pertinent contractual clauses in the contract document itself, or provide an appropriate statement which identifies the additional requirements. Provide a copy of the requirements to the cognizant security office. Use Item 13 if additional space is needed.)

15. INSPECTIONS. Elements of this contract are outside the inspection responsibility of the cognizant security office. [ ] Yes [X] No
(If Yes, explain and identify specific areas or elements carved out and the activity responsible for inspections. Use Item 13 if additional space is needed.)

16. CERTIFICATION AND SIGNATURE. Security requirements stated herein are complete and adequate for safeguarding the classified information to be released or generated under this classified effort. All questions shall be referred to the official named below.

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d. ADDRESS *(Include Zip Code)*
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e. SIGNATURE
T. Smallwood

17. REQUIRED DISTRIBUTION

- [X] a. CONTRACTOR
- [ ] b. SUBCONTRACTOR
- [X] c. COGNIZANT SECURITY OFFICE FOR PRIME AND SUBCONTRACTOR
- [ ] d. U.S. ACTIVITY RESPONSIBLE FOR OVERSEAS SECURITY ADMINISTRATION
- [ ] e. ADMINISTRATIVE CONTRACTING OFFICER
- [X] f. OTHERS AS NECESSARY 1221.1, 5712,5702

Affordably Expendable Unmanned Aerial Vehicles

White Paper

Prepared for

The Honorable Richard Danzig
Secretary of the Navy

By the

Tactical Electronic Warfare Division
Naval Research Laboratory
Washington DC

19 April 1999

Affordably Expendable Unmanned Aerial Vehicles

ONR exploratory research and advanced technology development programs at NRL are pioneering a new type of unmanned aircraft, Affordably Expendable UAVs. They are cheaper, lighter, smaller, and carry higher payload fractions than current UAVs. These features enable many of those missions now performed by conventional UAVs, plus potentiate new types of missions. Because their requisite technologies are now embodied in the civilian sector, they can be developed and fielded much more rapidly than current UAVs that rely on military acquisition cycles.

A serious shortfall for current UAVs is that their development process parallels that for manned military aircraft. This development process stresses a long service life, high level of maintainability, multi-role capability, and high reliability. The resulting UAVs are expensive, with life cycle costs and logistic complexities approaching those for manned aircraft. However, because of today's rapid advances in electronic and materials technology, these UAVs are virtually obsolete prior to their introduction in service. Moreover, they have been designed for a long service life, which exceeds the usefulness of the technologies they embody. Consequently, it has become apparent that the useful life of a UAV is a function of the life span of its constituent technologies, rather than its physical life.

Affordably Expendable UAVs for many applications can effectively break the cycle of long life spans that are used to justify high costs, and vice-versa. Three key factors are involved. First, the airframe and powerplant must be designed to be discarded when they have outlived their serviceability, rather than be maintained. Second, the system must be designed for fully autonomous flight operation, eliminating the requirement for extensively trained operators. Third, commercial availability, rather than military introduction must determine the requisite technologies. Affordably Expendable UAVs can logically embody the latest technological advances in a rapid development under best commercial practices. Resulting Affordably Expendable UAVs can be very inexpensive in comparison to current UAVs. Rapid development will insure that they are not obsolete when fielded.

Affordably Expendable UAV airframe capability can readily keep pace with electronic and materials technologies, and their intrinsic value will be high despite their vastly lower costs. Since cost is no longer a significant factor in their value, Affordably Expendable UAVs may be readily consumed in use. This disposability has a significant secondary benefit to the development cycle. Specifically, disposability supports the continuous production of newer variants, which accelerates the turnover of new technologies. So the cycle of high cost/ limited technology is replaced by a new cycle of low cost/ advanced technologies by embodying short life spans instead of long ones.

This new paradigm for UAVs is similar to that of the modern computer. Early computers were expensive to produce and maintain, and ran simple inexpensive software. Today's computers are inexpensive platforms for running extensive and valuable software. When modern computers outlive their usefulness due to advances in technology, they are discarded, even though they may still function. Similarly, Affordably Expendable UAV's can be affordably discarded when technology advancements render their capabilities obsolete, even though they are still functional as unmanned aircraft.

Another benefit of Affordably Expendable UAVs is the elimination of a massive inventory of systems that require continual, periodic maintenance. The size of inventory is determined by the rate that units can delivered from industry vs. usage, and insure that enough units are available to cover surges in usage. Since Affordably Expendable UAVs may be rapidly produced, numbers in inventory may be relatively small.

Definition

Affordably Expendable UAVs are therefore, relatively inexpensive platforms whose function is to carry or deliver the mission payload. They are no more complicated or sophisticated than absolutely necessary to conduct their individual mission. It is no longer essential, or in some cases even desirable, for the UAV airframe to survive more than one mission. Instead, its role may be to either relay back the mission data, or when carrying expensive payload hardware, bring back this hardware, or physical evidence obtained by the payload.

Affordably Expendable UAVs have evolved from technologies developed by NRL for ONR, in support of lightweight, low cost, expendables such as EW decoy air vehicles and jammers. In addition to autonomous flight operation and short design lifespans, research funding constraints forced these prototypes to use best commercial practices in lieu of meeting stringent Military Specifications. Although relatively inexpensive, these prototypes were able to perform successful mission demonstrations, and could often be recovered and reused when operating conditions were favorable. The modest reduction of reliability that occurred from the relaxing of specifications, was more than made up by a significant reduction in purchase and operating costs. The table, below, compares size, performance and cost between three NRL-developed Affordably Expendable UAVs and the two UAVs currently in production:

TABLE ON NEXT PAGE

	Conventional	Affordably Expendable	Conventional	Affordably Expendable	Affordably Expendable
	Pioneer	**Dakota-II**	**Pointer**	**SENDER**	**Extender**
Launch Options	Ground, Ship	Ground, Ship	Ground (Hand Launch)	Ground, Air, Ship	Ground, Air, Ship
Wingspan (Ft)	16.8	18.8	9	4	10.2
Length (Ft)	14	10	6	4	2.5
Empty Wt (Lbs)	350	128	8	8	22
Gross Wt (Lbs)	450	245	10	10.5	29
Mission Payload Wt (Lbs)	50	50	2	2.5	7
Propulsion	Gasoline	Heavy Fuel	Electric LiSO2 Battery	Electric LiSO2 Battery	Electric LiSO2 Battery
Endurance (hrs)	6	6.5	2	2	2.3
Cruise Airspeed (kts)	60	53	19	45	45
RF Link Range (km)	185	105	8	30	30
Cost [1] (Airframe+Engine +Avionics)	$667K	$70K	$25K [2]	$6K	$10K

[1] In all cases, avionics cost is greater than airframe + engine cost.

[2] Based on $170K cost for 3 airframes + 1 GCS

Affordably Expendable UAVs are not practical replacements for the largest, strategic type of UAV, since the extreme value of their payloads requires the high reliability of a fully maintained, reusable system. Affordably Expendable UAVs replace those UAVs whose missions place unacceptably high risks upon the airframe or could not otherwise be performed. Whereas most UAVs are strategic, a theater or battalion asset, the inexpensive Affordably Expendable UAV is an "organic" asset that supports the individual user's tactical requirements. It will allow the user to directly establish mission priority and directly receive its payload data, affording an unprecedented level of situational awareness. In addition, data fusion from a larger number of distributed systems will allow a more accurate assessment of the entire area of operation.

Affordably Expendable UAV Features

All Affordably Expendable UAVs discussed herein have the following features in common:

- Inherently small, advanced technology mission payloads
- Sized by the fuel/ energy required to perform the mission instead of payload size
- Autonomous flight operation
- Affordable expendability
- Rapid deployment from a compact storage container
- Built to "best commercial practice" in lieu of MilSpec
- Innovative/ simple fabrication, assembly, and checkout procedures
- Advanced composite airframe structures
- GPS navigation
- COTS components whenever practicable
- No-tool assembly (ground launch) or automatic unfolding (air-launched)

Affordably Expendable UAVs tradeoff lifetime for higher performance, but may be recovered and reused until damaged. They may be ground, ship, or air-launched, then fly at low speed and/ or high speeds. Affordably Expendable UAVs may be free flying, carrying their fuel supply, or tethered to the operator's location for their power. They bridge the size gap between future Micro Air Vehicles (MAVs) and current small UAVs such as the "Pioneer", Short Range UAV. Affordably Expendable UAVs are based on state-of- the-art technologies and are the smallest practical unmanned systems that can currently be developed. Since the availability of all requisite technologies for MAV development is several years away, the Affordably Expendable UAV fills the MAV operational requirements in the near term. The mission capabilities of Affordably Expendable UAVs go well beyond current UAVs and the airframes themselves are inherently covert, because of their small size, and composite materials construction. They utilize the latest available technology such as electric propulsion using high efficiency electric motors, microelectronics, GPS navigation, advanced composites, in-flight deployability, and artificial intelligence. While their basic components are COTS, most subsystems are tailored for specific functions. The need for missions beyond current UAVs, but within the scope of Affordably Expendable UAVs, is being driven by world events such as littoral warfare, terrorism and urban warfare.

Potential Development Areas

The most effective developmental approach for Affordably Expendable UAVs is an ACTD-like effort that delivers a limited number of mission-ready systems, engineering documentation, plus residual units for use in Fleet and mission exercises. This is the simplest way to transition Affordably Expendable UAV technologies to industry, and identifies commercial suppliers/ manufacturers. It establishes a direct transition path to low volume production of practical systems.

Affordably Expendable UAV technology can support a large variety of critical missions including:

- Close-in reconnaissance (daylight, low light, IR)
- Close-in surveillance (daylight, low light, IR, acoustic, radar)
- Radar and communication jamming (VHF, UHF, microwave)
- ESM (VHF, UHF, microwave)
- Unattended sensor delivery
- Deception, denial, confusion countermeasures (RF, IR)
- Psychological operations (acoustic)
- Sample collection (chemical agent, biological agent, nuclear)
- Target ID & marking
- Precision small weapon delivery
- Meteorology

An overview of several key missions not addressed by current systems, follows. Affordably Expendable UAV characteristics and estimates of the Navy's investment required to realize mission-ready systems, are included.

Close-in Reconnaissance

Current primary missions for UAVs include visible and IR imaging for reconnaissance. None of the current or planned UAV systems can provide the ability to quickly obtain a highly detailed, close-up image of a critical target. An Affordably Expendable UAV that is launched within its maximum range limit from such a target will be able to fly directly over, next to, or even into it. It can take high resolution, frame-by-frame digital images of the target, and directly transmit its data to a standoff

platform such as a tactical aircraft or satellite. Alternatively, for covert operations, the Affordably Expendable UAV can store the images onboard and physically return them to its operators. Because its low cost affords higher risks and occasional loss, this Affordably Expendable UAV will be uniquely capable of very low altitude flight. Operating under the weather, it can provide mission capability when all other overhead reconnaissance assets are ineffective.

This type of Affordably Expendable UAV will weigh between 20 and 40 lb which is sufficiently large to carry a COTS high resolution frame by frame daylight / low light video imager and an RF data link. At this size, it is inherently covert, too small to be perceived as a weapon if detected, and will not cause appreciable damage if it strikes the target. In addition to being ground-launched or ship-launched, several of these Affordably Expendable UAVs can be deployed from either one large UAV or any tactical aircraft. Electric propulsion will be used since is extremely reliable, has no vibration to blur imagery, and is virtually unaffected by weather. Current technology supports a 2-hour maximum flight endurance, giving a 100 nautical mile range or a 50 nautical mile ingress and 1-hour over target. Advancing fuel cell technologies promise many times this endurance in the future.

A 3-year development period with a total funding of $15M to $20M will allow the demonstration of several prototypes and delivery of 8 to 12 residual systems for training and missions by operational users. Transition deliverables will include a drawing package for the entire system to best commercial practices, detailed engineering and final reports, a transition plan, and 8 to 12 user's operating manuals. The estimated low volume production cost for airframe with its propulsion system is estimated to be $20k. The avionics system is estimated to cost an additional $40k, allowing a mission ready system, minus mission payload, to be produced for $60k.

Unattended Sensor Delivery

Another critical mission for Affordably Expendable UAVs is the precision delivery of unattended sensors to monitor enemy operations. Although the Close-in Reconnaissance airframe can also perform this mission, current MEMS technology-based sensors are becoming so small, that a much smaller Affordably Expendable UAV becomes ideal. A large number of these inexpensive micro-sensors can be readily carried and delivered by a small Affordably Expendable UAV. It would be able to operate at very low altitudes under the weather and deliver sensors with GPS accuracy. Upon dropping sensors, the Affordably Expendable UAV can either transmit their position or return to its operators with the geo-location information.

This type of Affordably Expendable UAV will feature electric propulsion and weigh between 10 lb and 12 lb. This size is sufficient to carry 60 to 70, 15-gram micro-sensors as its 2-lb to 3-lb payload. Because of its very small size, it is extremely hard to detect and is too small to be perceived as weapon. In addition to being ground-launched or ship-launched, several of these Affordably Expendable UAVs can be deployed from either one large UAV or any tactical aircraft. State-of-the-art technology supports a 2-hour maximum flight endurance, giving a 100 nautical mile range or a 50 nautical combat radius.

A 2-year development period with a total funding of $5M to $6M will allow the demonstration of several prototypes and delivery of 8 to 12 residual systems for training and missions by operational users. Transition deliverables will include a drawing package for the entire system to best commercial practices, detailed engineering and final reports, a transition plan, and 12 user's operating manuals. The estimated low volume production cost for airframe with its propulsion system is estimated to be $2k. The avionics system is estimated to cost an additional $4k, allowing a mission ready system, minus mission payload, to be produced for $6k.

Stand-in Jamming and ESM

The ability to perform radar or communications jamming with an Affordably Expendable UAV is an extremely effective, high value mission for the suppression of enemy air defenses. Conventional, airborne jamming requires a manned aircraft, equipped with a large and high power jammer, since the aircraft must remain out of the range of the site's defensive AA systems. An Affordably Expendable UAV can penetrate to within close proximity of the radar without placing a pilot at risk. This close range reduces the jammer power to a level, which can be readily provided by a small engine-driven alternator. In addition, the small physical size of the vehicle renders it difficult to engage with AA defenses. One Affordably Expendable UAV can effectively protect a large number of aircraft that are traversing the jammed sectors. Since the loss of the Affordably Expendable UAV is affordable, it can remain on station until exhausting its fuel, thereby providing the maximum amount of coverage.

With relatively long flight endurance over denied territory, an Affordably Expendable UAV can also be an effective ESM platform. It may either simply relay raw data to another platform, such as a UAV, tactical aircraft or satellite, or process signals onboard, and transmit refined information. When used in conjunction with other platforms, both manned and unmanned, several high value missions are possible. One example is precision DF of SAM sites, without placing personnel within range of the threat.

This type of Affordably Expendable UAV will have a total weight between 60 lb and 75 lb which is sufficiently large to carry 5 lb to 10 lb jammer or ESM receiver, power to operate the payload, and have a long flight endurance. Its powerplant will be a heavy fuel (JP-5 or equiv.) internal combustion engine equipped with a kilowatt alternator. State-of-the-art technology supports 12-hour maximum flight endurance, giving the ability to remain over a target, located 400 nautical miles from the launch point, for 6 hours.

A 3-year development period with a total funding of $15M to $20M will allow the demonstration of several prototypes and delivery of 8 to 12 residual systems for training and missions by operational users. Transition deliverables will include a drawing package for the entire system to best commercial practices, detailed engineering and final reports, a transition plan, and 8 to 12 user's operating manuals. The estimated low volume production cost for one mission-ready, Stand-in Jamming/ ESM Affordably Expendable UAV, minus its mission payload, is $80K.

The estimated low volume production cost for airframe with its propulsion system is estimated to be $35k. The avionics system is estimated to cost an additional $40k, allowing a mission ready system, minus mission payload, to be produced for $75k.

Individual Surveillance Asset

The need for an inexpensive, user friendly UAV that supports the individual user's requirements can be met by a miniature Affordably Expendable UAV, several years before MAVs fill this role. The imagery provided by this Affordably Expendable UAV would provide, as an organic asset, enhanced situational awareness. The operator will be able to safely see around obstructions, survey rooftops, look into windows, and view around corners, without exposing himself to fire in a hostile environment.

This miniature Affordably Expendable UAV will weigh 2 lb to 3 lb and be shaped like a flying saucer, with a diameter of about 12 in. State-of-the-art technology supports electric-power, driving ducted fans with active noise suppression. This will allow very quiet hovering for up to one hour on less than 300 watts of power. Power will be provided down a trailing conductor/ optical fiber tether, from a small rechargeable or Affordably Expendable battery pack carried by the operator. The payload will be either a color video camera or a low light video camera. Its imagery will be sent to the operator's helmet-mounted display via the optical fibers in the tether. The 300-ft long tether unspools from a

replaceable cartridge that will eliminate the need to rewind it after each use, or untangle a snag. To navigate, its operator will simply steer the camera's field of view, and all other flight operations will be autonomous. When not in use, it can be carried in a backpack.

A 2-year, 2-phase approach would provide early demonstrations and allow user input early in the development cycle. Phase 1 would conclude at the end of the first year with prototype demonstrations. Phase 2 would complete the development by the end of the second year. A funding level of $2.5M to $3M would support phase 1, which would feature several demonstrations with 2 prototypes. Phase 2 would require an additional $1.5M to $2M and provide 12 residual systems for training and missions by operational users. Transition deliverables will include a drawing package for the entire system to best commercial practices, detailed engineering and final reports, a transition plan, an 12 user's operating manuals. The estimated low volume production cost for one mission-ready, Individual Asset Affordably Expendable UAV, including payload and helmet-mounted display, is under $10K.

Summary

The Affordably Expendable UAV is born from the recognition that the useful life of a UAV is a function of the life span of its constituent technologies, rather than its physical life. Affordably Expendable UAVs enable the ability to conduct high value, high risk missions that are beyond the capability, or justifiability, of other systems. Because they use commercially available technology and do not require the provision to allow repair, Affordably Expendable UAVs are an order of magnitude less expensive to develop and produce than conventional UAVs. By their nature, Affordably Expendable UAVs allow the attrition of airframes without incurring indefensible costs, and reserve more costly systems for critical applications. They feature many of the desirable features planned for the future MAVs, such as being organic assets for greatly increasing situational awareness. All requisite technologies for the Affordably Expendable UAVs discussed in this paper are available today, thanks to an extensive small air vehicle technology development investment at NRL by ONR. Transition of these technologies to operational Affordably Expendable UAV systems is timely and well justified.

POC

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Acronyms

AA	Anti-Aircraft
ACTD	Advanced Concept Technology Demo
COTS	Commercial Off-the-Shelf
DF	Direction Finding
ESM	Electronic Surveillance Measures
EW	Electronic Warfare
GPS	Global Positioning System
MAV	Micro Air Vehicle
GPS	Global Positioning System
MAV	Micro Air Vehicle
MEMS	Micro Electro Mechanical Systems
NRL	Naval Research Laboratory
ONR	Office of Naval Research
SAM	Surface-to-Air Missile
UAV	Unmanned Aerial Vehicle

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